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The Mountain Empire UTAH

A BRIEF AND REASONABLY AUTHENTIC PRESENTATION OF THE MATERIAL CONDITIONS OF A STATE THAT LIES IN THE HEART OF THE MOUNTAINS OF THE WEST—CONTAINING FACTS AND FIGURES FROM AUTHENTIC SOURCES AND HAVING SPECIAL REFERENCE TO ITS FITNESS AND ADVANTAGE FOR THOSE SEEKING A MORE DESIRABLE PLACE IN WHICH TO MAKE A HOME, AS WELL AS SHOWING THE OPPORTUNITIES IT OFFERS FOR PERSONS HAVING MEANS WHICH THEY MAY DESIRE SAFELY AND PROFITABLY TO INVEST—A STATE THAT HOLDS AN EMPIRE'S WEALTH AND PRESENTS EVERY ADVANTAGE THAT ENERGY AND THRIFT MAY DEMAND—ITS SETTLEMENT AND ITS DEVELOPMENT SOCIALLY AND INDUSTRIALLY—ITS IMMEDIATE OUTLOOK AND ITS PROMISE OF FUTURE GREATNESS

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EDITED AND PUBLISHED BY

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SALT LAKE CITY, UTAH

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SALT LAKE CITY

A MONARCH OF THE PLAINS

The Pioneers

[By Judge C. C. Goodwin, former Editor Salt Lake Tribune]

THE sappers and miners who go out to storm the fastnesses of the wilderness, who set up the signal stations and blaze the trails, that later civilization may follow and light the darkness with its smiles, are called "Pioneers."

Through the ages their work has been the most important performed by men and women; the most important but least appreciated by the great thoughtless world; though at intervals, as when Aeneas, with his few followers, took his little company to Italy, or when Xenophon led his heroes on the long march from the valley of the Tigris, across the wilds of Kurdestan and over the rough highlands of Armenia and Georgia, to the shores of the Euxine; or when the Pilgrim Fathers, in their little ship, faced a winter's Atlantic voyage, and then, on landing, had the faith and strength to kneel on the frozen coast and offer a praise service to the Infinite for His mercies, the world has been touched and thrilled at the spectacle, and the story continues to ring out on succeeding centuries like a psalm.

Generally, when going out into the wild, Pioneers have been cheered and buoyed up by the hopes before them, by the ties of affection binding them to friends left behind, by blessed memories of friends and homes and the knowledge that they will not be forgotten, but, rather by the wireless telegraphy of love, prayers will daily and nightly ascend to Heaven in their behalf.

But the exodus to Utah was not like any other recorded in history. The exodus to Italy was to a land of sunshine, native fruits and flowers; the march of Xenophon's "Immortal Band" was a march of fighting men back to their homes; the exodus of the Pilgrims was to a new world of unmeasured possibilities; but the exodus of Utah was a march out of Despair, to a destination on the unresponsive breast of the Desert.

The Utah Pioneers had been tossed out of civilization into the wilderness and on the outer gate of that civilization a flaming sword of hate had been placed, which was turned every way against the refugees.

All ties of the past had been sundered. They were so poor that their utmost hope was to secure the merest necessities of life. If ever a dream of anything like comforts or luxuries came to them, they made a grave in their hearts for that dream and buried it, that it might not longer vex them.

Such was their condition as they took up their Western march. The spectacle they presented was sorrowful enough to blind with tears the eyes of the angels of Pity and of Mercy.

Day by day, the train toiled on its weary journey. There was the same limitless expanse of wilderness around them at dawn and at sunset. The same howl of wolves was their only lullaby as they sank to sleep at night. Only the planets and far-off stars, rolling on their sublime courses and smiling down upon them from the upper deep, were a nightly symbol that God still ruled, commanded order, and would not forget.

In sunshine and in storm they pressed onward for five hundred miles; then followed five hundred miles more over the rugged mountains which make the backbone of the continent. Their teams grew steadily weaker; more and more obstructions were interposed in their path; but they never faltered.

Men are supposed to bear such trials. These men had already received an experience which had, in a measure, prepared them for it. It was nothing for them to sleep with only the stars for a canopy. They had learned to economize food and clothing, and to smile at hardships and fatigue. Again the toil of the day made a bed on the prairie seem soft as down when they sank to sleep. Moreover, they were not gifted with vivid imaginations; they had accepted a faith which made them patient and obedient, and one day was like another to them.

But what must the women of that company have endured? What longings must they have repressed, and smiled while repressing them? Women love gentle homes; they have innate desires for fair garments, rich adornments; they dream of surrounding their homes and those whom they love with the grace and cheer and charm of their presence and accomplishments.

As the men slept, and the women lay listening to the bark of wolves and hoot of owls, and they felt the wild around them peopled with uncanny things, what must have been the cross they bore? They were nearing no land of vine and flowers and gold. Only the desert awaited them—the desert with its chill and its repellant face.

They reached it at last, and when their leader told them they had reached their chosen place, and they raised their voices in thanksgiving, it was a repetition of what was done on the shore of the Atlantic, and was as touching and as grand as when—

"Amid the storm they sang.
And the stars heard and the sea."

They began the work of trying to make rude homes. There was no hope except to live, and to live, merely, required incessant exertion and never-ending hardships. The earth would yield nothing without artificial help. Then there were the scourges of locusts, and of worms that blighted plants at their roots. They fought their way, they pushed their settlements from valley to valley against heat and cold, against the frontier and the savage, and persevered until flowers began at last to bloom and fruits to ripen, and they were able to draw around them some of life's comforts. Though what they did, they performed as a duty, still the record of it when written makes a page of history every letter of which is gold.

BRIGHAM YOUNG
Leader of the Pioneers, 1847

And whatever the future holds in store for Utah, that story of toil and suffering and final triumph should be held as sacred history to every man who honors devotion to duty in men, and self-sacrifice in women.

It should be taught to the children in the schools, and one lesson that should be impressed upon the mind of every child is, that a wrong act on his or her part would be a reproach to the brave men and women who came here in the shadow of despair and by incessant toil and by life-long self-abnegation laid solidly here the foundations of a State.

And out of the granite of these mountains should be hewed an imperishable monument, which should be set up in some conspicuous place, and upon it should be embossed words like these:

"They wore out their lives in toil. They suffered without plaint. From nothing they created a glorified State. Honor and reverence and glory everlasting be theirs."

Agriculture

Irrigation

THE primary and most potent institutions of Utah are those of irrigation. The establishment of irrigation works as the initial step in founding the first settlement in Utah was made necessary by the conditions that confronted the first home builders of the State who found here a soil which, while rich in all the other elements of fertility, was so lacking in moisture that the artificial application of water was indispensable to successful agriculture.

Without previous experience for a guide, the first irrigation works were necessarily crude and the results far from satisfactory. But sufficient was accomplished to inspire hope and encourage further effort which subsequently demonstrated the practicability of irrigation and pointed out its wonderful possibilities. Each year witnessed the completion of new works and the subjugation of additional land. Regarded at first as a despicable expedient, irrigation soon took its proper place as a fundamental institution. Its growth has been as rapid as its results have been remarkable. In a comparatively short time all the streams of the State that were not difficult of diversion had been turned from their natural channels and employed in the irrigation of adjacent lands.

In this way all of the water that could be utilized from the streams in their natural condition was soon appropriated. The natural flow of the streams is characterized by great fluctuation, yielding large quantities of water in the early season before irrigation begins, and a very meager supply in midsummer when the need for irrigation is greatest. In consequence there is great scarcity during the low-water stage of every year, although not more than about one-fourth of the entire water supply is actually used and three-fourths wasted by absorption and as flood and winter flow.

Lands that were previously barren and worthless, when brought under irrigation become surprisingly productive and correspondingly valuable. Fruit of most kinds are produced in great abundance and of admitted excellence. Vegetables of every variety grow to perfection. The yield of alfalfa and other forage crops is simply surprising. By common consent intensive farming and the co-operative ownership and management of all irrigation works became the rule at the very beginning. The early establishment of this ideal rule and its observance during a period of nearly sixty years has resulted in the entire area (about 600,000 acres) now under irrigation in the State being divided into numerous highly cultivated farms, the average size of which is less than thirty acres, and with one exception the works which supply the water for irrigating these farms are owned and operated by the farmers themselves.

Under these conditions this originally barren soil has often been made to produce crops of the nature and extent or value following:

Sugar beets, per acre, 33⅓ tons.
Alfalfa hay, per acre, 7½ tons.
Potatoes, per acre, 900 bushels.
Onions, per acre, 1,100 bushels.
Peaches, per acre (net), $400.00.
Cherries, per acre (gross), $975.00.
Raspberries, per acre (gross), $800.00.
Strawberries, per acre (gross), $800.00.
Grapes, per acre (gross), $1,200.00.

The population of the State as related to the irrigated area is now about one person to each two acres of land. The improvement in methods which will follow

a better knowledge gained from greater experience will no doubt result in a population of one person to a single acre. This, together with the ultimate enlargement of the irrigated area, will provide room for numberless new homes and a correspondingly greater population.

The further extension of irrigation in Utah depends upon the control and conservation of the water now wasted, and will require the construction of large and expensive engineering works quite beyond the reach of individual or ordinary

EAST CANYON RESERVOIR

community enterprise, and can no doubt be best accomplished through the agency of the National Reclamation Service.

Foreseeing the necessity for co-ordination of action between the State and the Nation in this most important matter, the Governor of the State recommended and the late legislature promptly passed a law creating the Arid Land Reclamation Fund Commission of Utah and making its chief duty the procurement of government aid in extending and improving the irrigation institutions of the State.

Through the efforts of this commission the scheme known as the Utah Lake project has been thoroughly investigated by the Reclamation Service engineers and reported upon as being capable of yielding a constant and certain annual supply of 1,000 second-feet of water during the entire irrigation season from May 1st to October 1st, or sufficient to cover 100,000 acres of land with water to a depth of three feet each season. The improved lake will have a capacity sufficient to impound 1,000,000 acre-feet of water, thus enabling the storage of surplus water to the extent of more than three times the contemplated annual consumption. This

great reserve will constitute an absolute insurance against a deficiency of supply during seasons of drought and completely cure the untold evils which have attended the heretofore fluctuating supply. The value of this contemplated equalization and control of the flow of water from Utah Lake cannot be overestimated. The details of a plan by which the work may be accomplished and paid for are well advanced and it is expected that the plan will be perfected in time to permit the beginning of work during the present season.

The same commission has recently prepared and submitted another and greater plan which contemplates the complete irrigation and reclamation of all the lands

LAKE MINNIE

of Cache, Salt Lake and Utah valleys, comprising about 1,000,000 acres of the most fertile land in the State. Although this land has only about one-third the water supply needed, there are already about 175,000 people settled upon it and the property which it contains is assessed on the basis of about $82,000,000. It is proposed to make the water supply sufficient by impounding all the water which now goes to waste from the several local streams and by augmentation from streams that do not naturally flow into these valleys, but that are tributaries of Snake River on the north and Green River on the south.

There is perhaps no other equal opportunity for successful work by the Reclamation Service to that here afforded. A State commission whose duties are co-ordinate with that of the National Reclamation Service officers; a numerous and wealthy community already established on farms even smaller than the Rec-

lamation Law provides and amply able to repay the cost of the contemplated works; a population whose natural increase in numbers insures the immediate settlement of all reclaimed lands; the experience of nearly sixty years of actual and successful reclamation work; a climate that is genial and invigorating; a soil unsurpassed in productiveness when properly supplied with water; an abundance of water that can be made available at reasonable cost; a ready home market which the extensive and varied mining operations of the State afford; easy and ample means of transportation, and an eager and earnest desire on the part of the people to have the great work go forward, constitute a combination difficult if not impossible to duplicate, and which cannot fail to insure the fullest possible success of such an enterprise.

The commission is also inquiring into the possibilities for a third project for the southern portion of the State and which it is hoped may be found as complete and practicable in meeting the requirements of that locality as the one already designed and described is for the northern portion of the State.

With the realization of the contemplated enlargement of the irrigation institutions of Utah there will come a corresponding expansion of all other and varied institutions. Thousands of additional homes will be established; new opportunities will be opened to the manufacturer, the merchant and the mechanic; the field for labor and capital will both be greatly enlarged, and general growth and prosperity will prevail.

It is evident that a new and progressive era for Utah is about to be ushered in, compared with which our past progress, magnificent as it has been, cannot be regarded as more than a mere introduction.

Reliable information respecting the extent of mains and laterals or the value thereof, or the subdivision of interests involved is unavailable. Data on the subject is being collected, but the labor involved may be partially surmised when it is stated that on the Weber River alone there are some nine hundred diversions of water. While the Weber is one of the considerable streams of the State, it is far from being the largest. Consequently the statement of the diversions on that stream alone will indicate clearly how deeply and indestructibly the irrigation system of the State is woven into its agricultural web and woof.

Omitting altogether data from some counties, there are 351 canals in the State with a capitalization of $28,029,932. Of this amount over twenty millions is in canals in Salt Lake County. With rare exceptions, the canals are owned by those who own the lands they water and the water follows the land in a transfer of the latter.

Cereals

While a very large proportion of the superficial area of the State of Utah is mountainous and for that reason not subject to cultivation, and while other large portions are so arid and remote from possible water supplies as to be valueless for agricultural purposes, nevertheless the State may be counted as a very liberal producer of all agricultural products. The natural soil, in the main, is extremely rich and of great depth, and has for years yielded cereals and roots without rotation or fertilizing, and still persists in producing a greater quantity per acre than the average eastern farm. The valleys have been made by deposits of soil from the mountains, much on the principle of the silt from a river making new and rich ground at various points. As this filling process has been going on for countless ages, and as the salts indispensable to plant life have been steadily accumulating in the valleys and are not leached out (as is the case in countries where the soil is but a thin layer above the bedrock), it necessarily follows that the farms in this State have

a producing capacity far beyond that of the average soil under cultivation in older states, where the conditions are not as favorable to the growth of plant life.

The general impression that the cultivation of farm products is not possible where there is no water for irrigation purposes, is not borne out by the facts, though the value of water for irrigation cannot possibly be over-estimated. Throughout the Rocky Mountains there are innumerable so-called "dry farms," and the growing of wheat on these farms has become a profitable part of the agricultural development of the region, and especially so in Utah. Wheat sown in the fall grows and matures from the spring rains. While the yield is nothing like as great as where irrigation is employed, so much larger areas can be brought under cultivation that the profits are practically as great from dry farming as from irrigation. There are, however, unfavorable seasons when the dry farm wheat crops are practically lost, and this is especially true if the fall-sown wheat becomes winter-killed, or where the spring rains are insufficient to give the young plant a start strong enough to enable it to mature.

GOVERNOR HEBER M. WELLS

The labor involved is necessarily much less, the area that can be sown by the mere harrowing and drilling in of the wheat without plowing is so much greater, that the deficiency in the yield of dry farms is made up by the increased number of acres that can be sown.

Then again, the alfalfa, or lucern, crop is a very profitable one on dry farms. Wherever a mower can be run at least one crop of lucern — once it gets a good start — can be grown each year, and as this will yield from two to three tons per acre, it makes a profitable crop for feed purposes. Vast tracts of land in Utah, which otherwise would be waste, thus are made to contribute to the general wealth of the State. The lucern seed grown on these lands is rated to have much more value than the seed grown with irrigation; it is more hardy and heavier, and as there is a constant demand for lucern or alfalfa seed, quite a material sum is added annually to the wealth of the State from this source.

No conception of the conditions that confronted the pioneers in Utah can be had by the person coming into the State to-day and beholding the present development. There are spots where some idea can be had of the sun-blistered and grease-wooded wastes that spread their uninviting areas before those who first located in the Salt Lake Valley. But these are rarely seen. Jim Bridger, after whom Fort

Bridger, in Wyoming, is named, declared to the Mormon Pioneers that he would give $1,000 for the first ear of corn raised in this State. In 1903 Utah produced 3,500,000 bushels of wheat and over 20,000 tons of sugar, while every known semi-tropical and temperate zone fruit grew to perfection in this State. The assessed valuation of property amounts to $120,000,000. The wheat yield for 1903 of 3,500,000 bushels should have been materially increased to have reached a normal production, but a series of winters in which the fall of snow was light and the spring rains less than the average, resulted in a shortage of water and the curtailing of dry farm crops. Besides this, a considerable area formerly devoted to the raising

BEAR RIVER CANYON
Showing Bear River Canal on the left and Hammond Canal and O. S. L. Railroad on the right.

of wheat has been devoted to the cultivation of sugar beets; still other tracts which formerly were devoted to the same purpose have been turned into the raising of lucern for the sustenance of dairy cows. It has always been difficult to get rid of the surplus wheat product of the State, by reason of the distance of the State from waterways and the difficulty of getting railroad rates which would enable the excess product to go to foreign ports. The result has been that the production of wheat has not begun to keep pace with the increased production in other directions, because of the uncertain profits. As a matter of fact, Utah is practically dependent upon the home consumption for her product of wheat, and while the home market is practically her own, she is not in a position to ask exorbitant prices for her cereal products, for the reason that flour from other states is always in competition with the Utah product.

The average yield of wheat per acre in Kane County in 1903 was 25 bushels, while in Millard County it was a fraction less than 11 bushels. This discrepancy is accounted for by the fact that the climatic conditions are not uniform over the State each season, and while they are not as friendly in Kane County as they might have been, they were vastly less favorable in Millard County—a vast tract of desirable land with but a very limited water supply.

As is shown elsewhere, under the heading of "Irrigation," projects are now maturing and practically determined upon which will give to the northern part of the State between 700,000 and 1,000,000 additional acres of land that may be brought under irrigation, the value of which to the State at large and as affording a means of

A MOUNTAIN FARM—ECHO CANYON

increased population to engage in horticulture and agriculture, cannot well be conjectured. When this project shall have been accomplished, it is a conservative estimate to say that from this source alone the taxable value of land in the State will have been practically doubled, as with sufficient water the land to be brought under cultivation will average in value not less than $60 per acre, and this, with the improvements to follow, will run the value up to in excess of $100 per acre. Plans are also maturing for the conservation of water now going to waste, which is to be applied to the vast tracts of dry land in Millard and other central and southern counties of the State, the effect of which will be, as already stated, not only to increase the values of the State, but to add infinitely to the population.

It is, therefore, unlikely that any condition can arise in this State where Utah will be dependent upon other sources than her own for her bread-stuffs. In fact,

she will always be in a position to export cereals if it can be done with profit. This is said with the full consciousness of the vast industrial and manufacturing undertakings certain to be inaugurated in this State in the near future. These will be consequent in a measure upon the development of the iron mines referred to elsewhere, upon the coal mines and of the hydrocarbons also mentioned elsewhere; the hydrocarbons referred to being distinguished from the coal mines.

The product of cereals and hay in the State for the year 1903 was substantially as follows: Wheat, 162,000 acres, 3,500,000 bushels; oats, 51,600 acres, product 1,800,000 bushels; barley, 11,316 acres, product 363,867 bushels; rye, 5,199 acres, product 65,426 bushels; corn, 10,238 acres, product 2,100,000 bushels; potatoes, 13,797 acres, product 1,748,608 bushels; sugar beets, 25,000 acres, product 300,000 tons; sorghum, 507 acres, product 53,067 gallons; lucern, 280,000 acres, product 800,000 tons; tame hay, 30,693 acres, product 64,923 tons; wild hay, 82,477 acres, product 103,110 tons. In addition to the above over 5,000 acres of land were devoted to various purposes not enumerated, the value of the product of which was about $350,000.

The nurseries of Utah cover approximately 1,000 acres and have an invested capital of about $300,000, and yielded for the year 1903 $125,000.

In horticulture and small fruits the division of land is as follows: Orchards, 15,000 acres, capital invested $1,500,000, value of the product $600,000; vineyards, 1,000 acres, capital invested $100,000, value of product $50,000: small fruits, 2,000 acres, capital invested $100,000, product $300,000.

There are a total of 23,000 farms in the State of Utah, with a total acreage of 1,643,000; less than 600,000 acres of this land, however, are regularly cultivated, and a part of this consists of what are called "dry farms."

The average yield of wheat per acre throughout the State is a fraction under twenty bushels, while on many farms the average yield is fifty, sometimes sixty, and even more, bushels per acre; but as already explained, the average product per acre is reduced by reason of the lesser yield of the dry farms. Each year, however, witnesses an increase in the average product of cereals per acre, which would indicate higher and more intensive farming, better knowledge of conditions and a capacity for overcoming such obstacles as are encountered in the variable water supply from year to year. It follows, therefore, that the outlook for agriculture in the State is brighter than it has ever been, not alone from the fact that the projects on foot towards a storage of the water are certain to be realized, but because our farmers are not only more diligent, but are certainly applying more intelligent methods to the development of their farms.

Utah's total surface area is 52,541,440 acres; of this area but 4,858,893 acres have been appropriated, and 5,574,068 acres reserved, leaving 42,108,479 acres still unappropriated. This of course includes mountains and elevated plateaus.

Utah, the Fruit Growers' Paradise

The delightful vocation of fruit growing, the poetry of agriculture, can be successfully followed in some of its many branches in nearly every county in the State, and judging from the unsupplied and ever-growing demand for fine fruit, it will be a long time before there will arise any fear of an over-supply of the product of tree, bush or vine in Utah. The climatic conditions affecting horticulture in Utah are practically an epitome of the whole United States, with added characteristics exclusively our own. The high mountain valleys are not unlike the vigorous climate of Minnesota and northern New England, except for its aridity, where none but the hardier fruits can be grown; the lower central valleys afford a climate as genial for the growing of fine fruits as the Central and Western States,

while the valley orchards of "Dixie," as Southern Utah is called, vie with California and the South in the production of the finest grapes, figs and other semi-tropical fruits. It is apparent, then, that an enumeration of the fruits that can be successfully grown in Utah would be, with slight modification, a catalogue of the known fruits of the world, excepting tropical. The prospective fruit grower has in Utah the choice of a wider variety of soil and climate to suit his fancy than is offered in any other State in the Union, with the possible exception of California.

That Utah offers almost unlimited opportunities for profitable fruit growing is fully demonstrated by the many thriving orchards that flourish in nearly every county in the State. The superior quality of Utah fruit was put beyond question by the magnificent and varied exhibit of all kinds of orchard products at the Irrigation Congress in Ogden last September. On that occasion there was shown to admiring thousands the largest fruit display ever collected under one roof west of Omaha. The Utah exhibit alone, collected and arranged by the State Board of Horticulture, was pronounced by experts the best ever shown in the West. The grape display from "Dixie" was equal in every respect to that shown from the Golden State of California, with double the number of varieties, besides figs and pomegranates.

FIG TREE—TOQUERVILLE

The fruit crop of the State in 1903 was hardly an average one. A splendid harvest of choice fruits of all kinds was produced in some districts, while in others it was a total failure, due to late spring frost killing the blossoms.

In its recent report to the Secretary of State, the State Board of Horticulture indicates a marked improvement in the horticultural conditions of the State. There has been a gratifying increase in orchard plantings. Well-kept orchards are becoming more conspicuous because more common; fruit trees are better cared for, better cultivation is practiced, and spraying and other disinfections are more generally carried on to keep in check fruit tree diseases and insect pests. As a result, the quality of the fruit produced in the State is much superior, bringing better prices and more ready sales.

The principal insect pests that trouble the Utah orchardist are the codling moth larvae and the wooly aphis. The San Jose scale exists to a limited extent in one or two counties, but can be kept under control by the use of the winter spraying solution of lime, salt and sulphur. Pear blight is a serious menace in some districts, due to neglect in fighting it on its first appearance.

The profits from fruit growing in Utah fully justify the hope displayed in the increased plantings. In favored districts many of the commercial orchards of the State yielded their owners from $200 to $300 per acre for the season just closed. Instances might be cited showing returns of $500 to $800 per acre from small fruit culture, where these have been made a specialty on small areas.

The soil and climatic conditions of Utah are peculiarly adapted to fruit growing. Hardy fruits of every description thrive in nearly every county of the north and central sections of the State, and in the counties of San Juan, Grand and Washington, particularly in the last named, semi-tropical fruits, as the grape, figs and pomegranates, are produced in abundance. Grape growing is fully as well adapted to the southern part of the State as in California, and the raisin

WASATCH MOUNTAINS

product is pronounced by experts and chemists to be superior to that produced in the Golden State. This industry promises to become a leading one in Southern Utah.

If the growing of fruit is systematically followed in all its details with the same scientific care as is given to the growing of sugar beets, there is no branch of farming in Utah that can compare in profitable returns with the produce of the orchard. Where climatic and other conditions are so favorable as in Utah, fruit growing is not only the most lucrative, but the most pleasant and fascinating of all agricultural pursuits. No locality in the West offers better opportunities for commercial fruit growing than does Utah. The success of many extensively engaged in it, particularly in the north central sections of the State, attests this claim beyond all doubt.

The control of moisture is one of the special advantages the Utah fruit grower has over his eastern competitor, a condition that contributes largely to the success

SHEEP HERD

of the local orchardists. Where irrigation water is so valuable as it is in this State, business economy suggests the growing of such crops as will require the least water to mature, and for which there may be obtained the fullest returns. The peculiar adaptability of the soil and climate of Utah to fruit growing on an extensive scale offers the most profitable returns for the use of all the irrigation water available. Water that will mature a $40 crop of wheat to the acre will produce a $200 crop of the larger fruits and $300 to $800 crops of berry fruits. These are conservative estimates, based upon crops grown in various sections of the State.

Sheep

The sheep and wool industries in Utah during 1903 were not as profitable as in years gone by, nor is the immediate future outlook as encouraging as could be hoped for. In the past, Utah has been a great wool producer. So profitable in fact was this industry that the available grazing lands became overstocked, with the inevitable result that sheep raisers have sustained, within the past few years, very heavy losses. The overstocking of the public ranges would probably not have been responsible for the losses referred to, but for several years continued drouth has partially destroyed the ranges. Added to this has been the curtailment of the range by forest reserves through administrative action, and the rental and sale by the State to private parties of lands formerly open to occupancy by flockmasters generally.

The severe winters, long continued cold spells and insufficient feed caused by poor ranges and drouth, already stated, have cut down the Utah herds fully forty per cent. since 1900. On the whole, prices for wool have not been so good as formerly, although fat lambs and wethers brought good prices in the Eastern markets. This, however, is not so favorable a condition when the loss of flocks is remembered, and that fat wethers are hard to find on overstocked and insufficient ranges, after hard winters and with a prevailing scarcity of feed. These conditions obtaining, the wool clip is also bound to be deficient both in quality and weight, and a loss of fully thirty per cent. was felt from these causes during the past year.

The year 1904 promises better fortune to sheepmen, as the winter ranges were in much better condition than usual when the flocks moved on them; besides the flocks, as stated before, have been greatly reduced, which necessarily affords better range opportunities for the fewer numbers remaining.

In 1900 the government census showed 3,818,423 sheep in the State of Utah, divided as follows: Ewes, 1,983,802; wethers, 659,332; lambs, 1,625,289. The total value of these was $10,256,480.00. The lamb and wether crop of that year was, approximately, of the value of $5,000,000, and the wool crop totaled $1,800,000.

For 1903, the State inspection, as reported by Jesse M. Smith, president of the Utah Woolgrowers' Association, shows a total number of 1,853,790 sheep, showing a loss of nearly 2,000,000 head. The wool crop from the same was about $1,500,000; the lamb and mutton crop about $2,400,000; total, $3,900,000, a falling off since 1900 of some $3,000,000 annually.

Disheartening as conditions have been and still are, there are many heavy and intelligent flockmasters who see a bright future for the sheep and wool industry. Utah has much in its favor. It embraces a large natural area for range sheep raising, and while the production of wool per sheep is not so great, the extensive operations of those engaged in the pursuit make its possible profits very alluring. The Great American Desert affords infinite pasturage for sheep in the winter time, while the extensive mountain area is ideal for summer grazing. These sheep are easily moved from point to point, traveling slowly, but grazing as they go, and thus during seasons traverse really great distances. Little food is neces-

sary and less water, and the many obstacles that confront the driving of other live stock are wanting for sheep, and, as already stated, render Utah an ideal field for sheep ranging. This it is, together with the great profits made at times, that has induced so many to turn to sheep ranging as a business.

Nor is the Utah flockmaster wanting in knowledge of the business. The grade of his flocks is constantly and faithfully maintained by the introduction of the best grade of blood obtainable. The Merino and Cotswold mixed are counted the most valuable sheep. The combination makes a heavy and hardy sheep —sheep that stand the winters, produce weight in mutton and yield well in wool. Under favorable conditions these sheep would average 12 to 15 pounds of wool annually; but this figure is far from reached because range sheep run through brush and the fiber of the wool is broken and thus a heavy loss results. Handled in small bunches on a farm with sufficient and regular food, and these sheep have averaged, year after year, 17 pounds of wool per head. It necessarily follows that the handling of vast herds wholly dependent upon the seasons for food often results in years when the losses are well night disastrous to many.

In Utah may be found some of the best bred Merino and Cotswold sheep in the world. Mr. W. S. Hanson, of Box Elder County, and Mr. John Seeley, in Sanpete County, carry, perhaps, the best grade of Ramboulette sheep to be found anywhere. Allen Brothers, at Draper, Salt Lake County, possess the largest herd of pure blooded Cotswold sheep known to exist.

The interests of the flockmasters of the State are under the watchful care of the Utah Woolgrowers' Association, the officers and vice presidents of which are here named:

Jesse M. Smith, Layton, President; Heber A. Smith, Draper, Vice President; O. P. Hatch, Bountiful, Secretary.

W. D. Candland, Mt. Pleasant, James H. Moyle, Salt Lake City, J. S. Ostler, Nephi, Executive Committee.

County Vice Presidents—B. R. Meek, Salt Lake County; Jos. R. Olsen, Box Elder County; Stearnes Hatch, Davis; R. G. Miller, Carbon; J. C. Whattaker, Piute; Wm. Kirk, Utah; Alma Magleby, Sevier; J. S. Ostler, Juab; J. L. Wrathall, Tooele; John Nebeker, Rich; Louis Anderson, San Pete; John E. Austin, Wasatch; Preston Blair, Weber; John Paskett, Summit; Jas. Kippen, Morgan; S. R. Bennion, Uintah; Jos. Nielson, San Juan; Wilford Day, Iron; Isaac Jorgenson, Cache; Heber J. Meeks, Kane; Thos. Sevy, Garfield; C. W. Watts, Millard; J. W. Seely, Emery.

Cattle

Cattle growing in Utah has undergone in the past ten years so marked a change that it is doubtful if a considerable number of our own people even have realized the passing of the picturesque "puncher," the rodeo grande, and the homely but hospitable chuck wagon. Big herds and a few big cow barons have given way to small bunches of cattle and a multitude of owners; the open range, unbounded in extent, to the pasture proposition, often very limited in area; and the riata and the saddle-iron of the cowboy's palmiest period, to the squeeze-gate and stamp-branding iron of this prosaic day.

Formerly an exclusive pursuit in this State, the business of raising cattle here now is more generally followed as a mixed occupation in conjunction with farming, and its permanence and perpetuity appear best assured along these lines.

The appropriation of the living waters for manufacturing and agricultural purposes, and the occupancy of water front lands by actual settlers for planting, restrained cattle in their liberty of movement and restricted them in their use of the range to a degree which made it difficult for them to rustle a living for themselves; and when their opportunities were further encroached upon by increasing hordes of sheep in their endless migration over the public pasture domain,

winter feeding became a fixture among the methods and provisions of the business.

The effect of the change from large herds to small holdings and the resultant difference in the methods of handling the business, is particularly noticeable in the quality of the cattle now being bred in Utah. The reduction in numbers permits better control in the breeding and the increase in the number of owners has induced greater liberality of expenditure for new blood to improve the older strains. Consequently Utah cattle are rapidly becoming high grades of the beef type, and as such are in great demand by the feeders of the corn States who depend more and more, as the farming conditions east of us alter, upon western territory for the meat steers they must mature in order to make a sure market for their corn.

From a physical point of view the cattle business in Utah is in better shape than it ever was before. Owners have reduced their herds to such numbers as their pastures and summer ranges will provide for in ordinary years, and their hay crops will supply with winter feed in case of necessity. They are no longer so dependent upon favoring rains in summer and fair weather at other seasons. In a word, they are doing more for themselves and their belongings, and leaving less for the accomplishment of fortuitous circumstances, or other uncertain agencies, and the business is on the mend, for the individual, and as a feature of the State's wealth as well.

In common with the producers of the country at large, Utah cattlemen suffer under price depressions from time to time, which are not traceable for cause to the established laws of supply and demand; and at this writing owners are affected, it is confidently believed, by the unfair manipulation of the large operators located at the big markets. Discriminative rates favorable to the latter points as against cities of importance situated much nearer the point of production, have been long maintained by the transportation companies; and this favoritism has resulted in the centralization at the five big markets of 80 per cent. of the fat cattle, sheep and swine of the country whenever they are in condition to kill. The low through rate discourages intermediate selling, and gives the eastern packer, or beef buyer, an advantage over his western competitor, which has kept the operations of the latter down to slaughter-house proportions to date; and it also imposes upon producing shippers the maximum shrink in flesh and figure of cost for maintenance incidental to long shipments.

Indications, however, now point to modifications of the evils which have been long complained of that will effect great savings to western producers, and Utah stockmen are prominently connected with the general movement through which this economy is to be secured. The cost of transportation, since the forced abandonment of movement by trail, has been one of the heaviest burdens the live stock business of Utah has been obliged to bear; and the item of freight charge has only slightly exceeded in dollars and cents those others included in the term "cost of transportation," to-wit: shrinkage and damaged appearance, usually the result of bad service. The plan perfected will include also means for diminishing the control of the supply which the present small coterie of buyers exert through the centralization of receipts at the doors of their abattoirs, as well as other reforms in the present methods of moving and marketing meat animals of great economizing value to the producers of this and other States.

At the last annual meeting of stock growers at Portland, Ore., it was suggested that those engaged in raising live stock for the market should protect themselves against the exactions of buyers by establishing their own abattoirs and packing houses. How effective and far-reaching this movement will prove, and by what methods it will be undertaken, or whether it will be met by such reductions as may satisfy the grower, time alone will demonstrate, but the result of the issue is of vital importance to Utah as an integral part of the cattle growing West.

The total output of cattle from Utah during the year was under 40,000 head,

or about 35 per cent. less than it was in 1902. The bulk of the turn-off went to ranges in other States and the decline in price realized was therefore less than the average market decline.

The consumption within the State increased considerably during the year. In addition to special conditions, such as the material local railroad construction, which contributed to this increased use of the home-killed supplies, people of the cities and the towns have continued to indulge their beef appetite, notwithstanding high prices.

The combined consumption has used up fully 60,000 cattle during the year. These represent a value of about $180,000. The loss was somewhat above normal, probably 2,700 head.

Swine

It does not seem that the intention to raise hogs and make them marketable has seriously taken hold of the people of this State yet. Just why it has not, in a region so productive of the small grains, roots and other truck so highly esteemed in other countries as bacon-makers, is not apparent. It is a well known fact that the barley and root-made hog products of Ireland, Scotland, England, Denmark and other countries readily command prices that run anywhere from 40 to 75 per cent. higher than those of American manufacture. The principal reason given for this discrimination is that the home articles are made from corn-fattened hogs, and that the products are gross, lacking in flavor and less palatable because of such diet.

They may not know what good bacon is across the pond, but they use all that is made over there, and they pay the premium stated for the article made, by feeding just such truck as every Utah farm and garden produces in excess each season. It is often urged that a lack of packing facilities locally is responsible for the lack of attention to swine growing. The claim has some merit, but packing houses without hogs to pack, and that in numbers and at times that insure the continuous operation of such plants, are beyond the ability of any to command as money-making propositions. It requires a complete plant, equipped with modern contrivances, to operate against the powerful competition of the enormous aggregation of wealth engaged in this business at eastern centers; and to justify the erection of such plants, their equipment with the requisite machinery, and the association of money necessary to operate them, the following are essential requisites to investors: Fat hogs, fat cattle, fat sheep, at all times in the year, in sufficient numbers and at prices on a par with those prevalent where other packers make their purchases.

Cattle are fattened in the State to meet the demands of local consumption, and with profit at local prices to those who feed them, evidently, as the native product continues to shut out pretty effectually importations of dressed beef; and the quantity and quality of Utah mutton has been sufficient for home consumers up to date. For our supply of hog products, on the contrary, we have always depended, more or less, on the production of other states, and the commendable efforts of local packers, operating under great disadvantages and constantly increasing difficulties, have utterly failed to remedy the defect. The efforts referred to were directed to the encouragement of hog-raising and their subsequent preparation by the payment of prices for hogs equal to and often higher than ruled on eastern markets for swine of better quality. This artificial stimulus to the business of hog-raising was costly to the local packers who were public-spirited, and they were forced out of business. Since then our bacon making and hog packing have been on the slaughter-house scale, one of minimum proportions.

Educational and Social

Public Schools

THE State school law requires the attendance of all minors between the ages of 6 and 18 years at school for a fixed number of months in each year, and affords gratuitous tuition. Free school books for those attending may be provided under the law by the several school boards, at their option. This fund is met by a general tax levied against all taxable property. A tax of three mills is levied by the State for general school purposes. Within fixed limits the counties fix the assessment for school purposes. In cities of the first and second class, school interests are controlled by an elective board, and the levy for school purposes is devoted to educational purposes in each city of that class.

The total school population for the State for 1904 was approximately 90,000 pupils; number of school buildings, about 709; value of school buildings, approximately $2,750,000; number of teachers employed, 1,662.

The Public Schools of Salt Lake City, Utah

In its onward movement Salt Lake's school system entered its present era in 1890, when the free school law, commonly designated the new school law, was enacted. This, however, did not mark the advent of the first free schools in our State, as some districts had previously availed themselves of the "local option" provision of former laws and had established free schools. But the enactment of this law did bring the free school within the reach of every child in the State, although tuition had formerly, in most cases, been merely nominal. In addition to the then existing country district, it established, by means of consolidation, districts to be known as cities of the first and second class, of which there are four in the State, Salt Lake City being the only one of the first class; those of the second class being Ogden, Logan and Provo.

By one act the legislature converted Salt Lake City into a single school district, with boundaries corresponding to those of the corporate city. Where previously twenty-two school districts, presided over by as many boards, each consisting of three members, were to be found, there was brought into existence a single school board with a constituency of only ten members, thus simplifying the administrative machinery and at the same time giving added power. A school superintendent, elected biennially by the voters and vested with but limited advisory power in the selection and recommendation of teachers to the various school boards of the city and county, was replaced by one appointed by the Board of Education, paid a liberal salary and clothed with all necessary authority to effect a reorganization along the new lines.

And at this time a demand from the whole State came for more teachers and better teachers. The new school law provided new opportunities, and the country school districts, like Salt Lake, were not slow to avail themselves of these. Although the public schools of our State, from the very time that the first little log schoolhouse in 1847 was constructed, had ever striven under the most untoward conditions to fulfil the purpose of their existence, it might be said with truth that as a reward and result of the struggles and persistent efforts of those most interested in educational affairs, a new era dawned in 1890. Beautiful and commodious

structures sprang up, as if by magic, on every side, until now in nearly every district in the State the best and costliest building is the schoolhouse. In many cases a heavy bonded indebtedness was necessary, but the means employed found justification in the end to be attained.

A notable and important measure was adopted in Salt Lake and other cities at the beginning of the year 1892-93, when free text books and supplies were furnished to all grade pupils. Since then the poor boy has had practically every opportunity enjoyed by his more fortunate companion, and the result has made itself manifest

WASATCH SCHOOL
One of Salt Lake's Public Schools

in his progress. Under former conditions, the advancement of every class was, to an extent, checked by those that were without the necessary books and materials. The change not only reduced the total expenditure for books in the city, but it also increased the quantity and variety of reading and reference books, and thus added perceptibly to the interest of class work. In short, the success of the free text book plan has surprised even the most ardent supporters.

The year 1892-93 saw the introduction of supervisory work, a supervisor of primary schools having been elected at the beginning of that year, and, later, supervisors of music and drawing were added. In addition to this, principals devote their time almost exclusively to supervisory work in their respective buildings.

The statute creating the school district of Salt Lake City provides that "the

public school system therein shall be controlled by the board of education." The meager compensation allowed has precluded office seekers from membership, while the time of year when the election is held has kept the board entirely free from the baneful influences of partisan politics. As a consequence, men of more than ordinary business and professional sagacity have been chosen. This has given to the various boards a real strength in their constituency that has made efficient and businesslike administrations possible, and has insured to the schools at all times a policy essentially broad-minded and liberal, but yet conservative.

The last school enumeration for Salt Lake City, taken in the latter part of July, 1903, showed 15,987 children of school age (6 to 18 years), about 30 per

UTAH BUILDING AT WORLD'S FAIR, ST. LOUIS

cent. of the total population. Of these about 13,000 are now registered in the primary and grammar departments and over 900 in the high schools. About 550 pupils receive certificates of promotion to the high schools each year. From 55 to 65 per cent. of these enter the high schools and a large proportion of the others enter the state preparatory school and private schools. From 80 to 100 students are graduated by the high school each year in its four-year courses and 25 to 30 in the two-year commercial course.

The course of study for the grades covers a period of eight and one-half years, and includes the branches taught in all first class systems, manual training and sewing being among them. The high school offers strong four-year courses

that satisfy all entrance requirements to the best colleges in the United States. Military training is required of all boys during the freshman and sophomore years. A good commercial course of two years is well patronized.

Three hundred and ten teachers are employed in the grades and thirty-five in the two high schools. The grade teacher receives from $40 to $80 a month, and the high school teacher from $75 to $120, the gradation being determined on merit. The schedule provides for a yearly increase of $20 to $75 until the maximum is reached. Grade principals are paid from $84 to $145 per month, and high school from $150 to $250. Teachers are employed for nine months and principals for ten, the latter being at their post of duty one or two weeks before and after the school term.

Each year the board appoints a limited number of inexperienced graduates of accredited normal training schools to act in the capacity of assistants for the period of one year. If their work proves satisfactory, they are reappointed at an increased salary. Only such non-graduates are appointed as have had several years of successful experience elsewhere. In its personnel, Salt Lake City has perhaps the most representative corps of teachers in the country, there being one or more teachers from practically every State in the Union.

Salt Lake City owns twenty-three school buildings, having a total value of $850,000, and a seating capacity of about 13,000. With several exceptions the buildings are strictly modern and have from ten to twenty rooms each. They cost from $4,000 to $70,000 each, although the present value is much above these figures. All are built of brick. The Lafayette, located at the head of State street, is nearing completion and will be ready for occupancy in September. Besides a large assembly room containing five hundred opera chairs, it will have eighteen class rooms. The cost will exceed $120,000.

School revenues come from two sources—taxes, and interest on money received from the sale of school lands. At present the latter is of little consequence. For the year 1903-04 the State school tax of three mills will furnish about $70,000; the county school tax of two and two-tenths mills, $52,000; and the city school tax of five and two-tenths for maintenance, $190,000, and of one and five-tenths mills for buildings, $55,000. For sinking fund and interest on bonds, about $46,500 will be received. The State and county taxes are apportioned on the per capita basis.

MISCELLANEOUS.

Estimated value of school property	$ 1,218,664.80
Valuation of taxable city property (1903)	34,505,148.00
Cost of superintendence and instruction (approximate)	206,437.50
Cost of books and school supplies	26,180.78
Total cost of maintaining the schools, per capita (1903)—	
(a) Based on average number belonging	29.35
(b) Based on enrollment	24.90
Cost of books and school supplies, per capita, based on enrollment (1903)	1.93
Average cost of books and school supplies, per capita, for past ten years, based on enrollment	.94

Colleges and Higher Educational Institutions

The colleges of Utah are in every sense modern and up-to-date not only in equipment and management, but in the character of their graduates they invite comparison with any other part of the world.

THE UNIVERSITY OF UTAH, the State's pioneer institution of learning of higher grade, was founded February 28, 1850, a little over two years after the pioneers entered the Salt Lake valley. It is located at Salt Lake City and, from its splendid station on the east bench, commands a magnificent panoramic view of the Great Salt Lake valley. The foundations of this institution were laid in the poverty and distress of the early settlers, but they were laid broad enough and deep enough for future building upon, and each successive generation has been loyally active in adding to it, making possible the present gratifying condition. In connection with the university is a State normal school, a State normal kindergarten and a State school of mines. The completeness of the equipment of these schools has drawn unstinted praise and sincere compliments from educators of national repute. Mining is one of the State's principal industries, and it seems to be the ambition of the board of regents to make the State school of mines the most noteworthy and perfect of its kind in the West. Among the courses provided for are science, arts, literature, advanced normal work, mining engineering and electrical engineering. The present site of the university and allied schools was a gift from Congress. It comprises sixty acres taken from the Fort Douglas military reservation. In addition to this the university and the State school of mines were granted by the National Government 255,836.15 acres of public lands, and it is from the revenues of these grants and the biennial appropriations of the State legislature that this institution derives its support.

A State normal school, a branch of the State university, is located at Cedar City, in Iron County.

THE AGRICULTURAL COLLEGE AND EXPERIMENT STATION OF UTAH is superbly situated on the brow of a bold and picturesque hill, at Logan, in the beautiful and rich valley of Cache, and is about one hundred miles north of Salt Lake City. This also is one of the State's chief educational institutions. It enjoys a public land grant of 200,000 acres, and is further supported by appropriations from the State and National government. The college comprises six different schools, besides an agricultural experiment station. Courses therein embrace agriculture, domestic science and arts, engineering, commerce, general science and a school of manual training. These schools embrace eight baccalaureate courses, each extending through four years; three certificate or high school courses, each extending through three years; two manual training courses, extending through three and four years, and three winter courses—agriculture, domestic arts and mechanic arts.

DEAF, DUMB AND BLIND INSTITUTE.—An institution of the State which attracts a great deal of sympathy and which is worthy every possible encouragement is the State school for the deaf and dumb and the blind. This school, supported by State appropriations, is located at Ogden, Utah, and enjoys the distinction of being a model institution of its kind. There is also a State reform or industrial school at Ogden.

The Latter-Day Saints, or Mormons, have two universities, one college and several stake academies in Utah, where, besides the peculiar tenets of their faith, are taught all the general branches or courses common to similar institutions throughout the land.

THE BRIGHAM YOUNG UNIVERSITY, at Provo, Utah, is the pioneer Mormon school in Utah. It was founded in early days and richly endowed by the leader and pioneer whose name it bears, and from the start it has been a most popular institution. There is a branch of the Brigham Young University of Provo at Beaver, in the southern part of the State.

Logan, Utah, is the home of the BRIGHAM YOUNG COLLEGE, an institution that had its birth in the generosity of the Mormon leader, and of which the State

is justly proud. This institution he endowed with close on 10,000 acres of land in Cache valley.

The Latter-Day Saints University, Salt Lake City, is another church institution of great popularity. The buildings of this university are just across the street east from the famous Temple, and, when they are completed, it is intended they will form one of the most charming architectural groups in the West. There is a splendidly equipped business college in connection with this university, which is attended by a great many outside the Mormon church.

In the Weber Stake Academy, Ogden, Utah, has one of the principal church schools. The Snow Academy, at Ephraim, Utah; the Emery Stake Academy, at Castle Gate, and the Uintah Stake Academy, at Vernal, complete the list of larger Mormon schools in Utah. All of these are in flourishing condition.

There are other church schools in Utah belonging to the Catholics and the various protestant denominations, which shed luster on this State, and which will be found mentioned in connection with the churches by which they are controlled.

Art Institute

The Art Institute is a State institution for the encouragement of the fine arts, and involves, according to law, "An annual art exhibit, a State art collection, and a course of public lectures on art."

This is one of the public institutions of the State for which appropriations are made biennially by the legislature. And although only in its infancy it has held four annual exhibits, awarded cash prizes and medals for the best productions in the various branches of fine arts, and in other ways has done much to encourage artists and the study, both privately and in the public schools.

Churches

Church of Jesus Christ of Latter-Day Saints.—Numerically membership in the Mormon Church, or Church of Jesus Christ of Latter-Day Saints, exceeds that of all the other denominations in Utah combined. The value of its ecclesiastical holdings of property and buildings is infinitely greater than that of all other religious organizations in the State together.

For its purposes the Mormon Church has divided the State into what are called "stakes," and "wards" and "teachers' districts" and "blocks." As a rule a "stake" is usually the same territory as that of a county, though it sometimes occurs that there are several stakes in a county, and sometimes more than one county in a stake. Also, the church ward usually equals the municipal ward, though at times there may be several church wards in a municipal one, or more than one municipal ward in a church one. Each stake is presided over by a president of that stake and two counsellors. Each ward is controlled ecclesiastically by a bishop and two counsellors. In each ward also are teachers and deacons, the former having districts within each ward assigned them for periodical visits to inquire into the spiritual condition of church members. The duty of deacons is to care for places of public worship.

In each stake are a president and counselors of Sunday schools, with corresponding officers for each ward in the stake. The same is true of Female Relief societies, organizations specially designed for the investigation and amelioration of cases requiring charity. A similar organization exists as to the Young Men's Mutual Improvement and the Young Ladies' Mutual Improvement Associations, for each of which there are stake presidents and counselors and lesser officers for the several wards in each stake.

There is a Council of High Priests for each stake, before whom all cases of dissension between members of the church are tried and decided, after having first been submitted to the teachers, bishops and counselors of each ward and failing of satisfactory settlement there. From the High Council of each stake, each member has the right of appeal to the highest authority of the church.

Over all these are general officers who control all the organizations named for the several stakes. These are known as the general officers of the various organizations stated and subject to them are all the lesser organizations of the church throughout the world, as relates to the interests placed specially under their care.

JOSEPH F. SMITH
President Church of Jesus Christ of Latter Day Saints

Over all the church interests throughout the world are the president of the church and his two counselors. Next come the twelve apostles. Then the seven first presidents of the Seventies' quorum. Then are the elders' quorums. Practically every male member of the church who is not a deacon is either a seventy or an elder, and there are subdivisions of the seventies' and elders' organizations that substantially correspond with the subdivisions already named as to other bodies of this church.

There is a presiding bishop and two counselors for all the church, and these control all the lesser bishops of the entire church organization throughout the world.

Beyond all question some of the most magnificent structures in the whole western part of America are those of the Mormon Church. This is notably true of the Salt Lake Temple and the great Tabernacle.

Each stake has a large stake building at which quarterly conferences of all the members in that stake are held. In each ward periodical conferences are held, and semi-annually, about the 6th of April and the 6th of October each year, a general conference of all members of the church for the world is held in Salt Lake City, though its holding there is a matter of convenience and is in no sense enjoined.

There are four Mormon temples in Utah, the most imposing and costly being that at Salt Lake City. The others are at Logan, in Cache County; Manti, in San Pete County, and St. George, in Washington County.

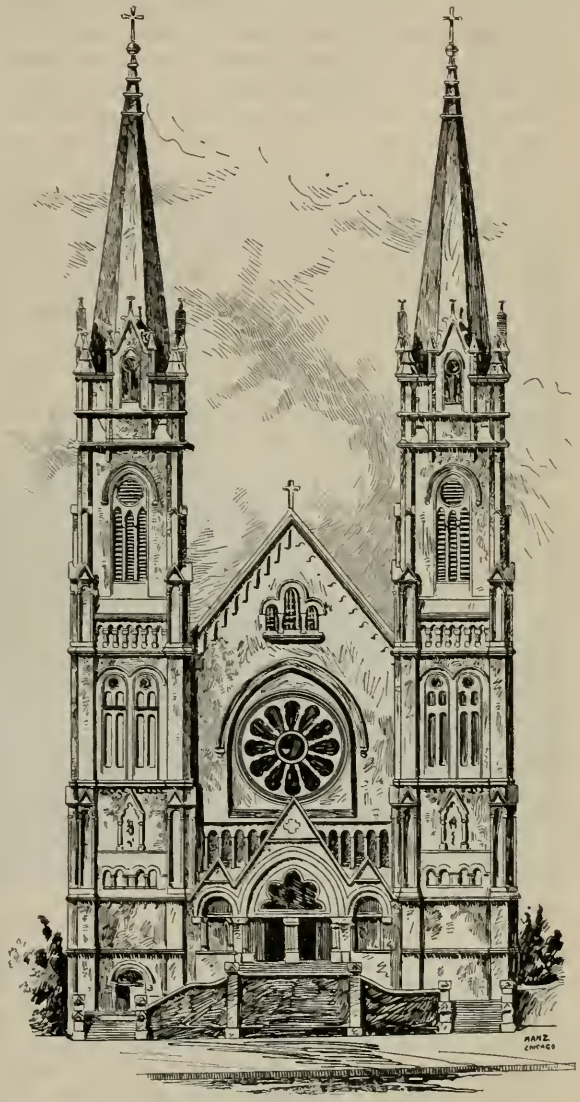
Catholic Church and Institutions.—Rev. E. Kelly was appointed the first resident pastor of the entire territory of Utah for the Catholic Church. During

THE MORMON TEMPLE

his pastoral charge, Father Kelly purchased the site on which the first Catholic Church, now used as a pro-cathedral, was erected. Later Rev. P. Walsh was sent from California to take charge of the parish. He built the present church on Second East Street. In August, 1873, Father Walsh was succeeded by Rev. Lawrence Scanlan, the present bishop of the Diocese of Salt Lake.

In 1875 Father Scanlan founded St. Mary's Academy on Second West Street. The original building, which has since been more than doubled in its capacity, is a three-story brick building, stone basement, surrounded by spacious grounds. In this building school was opened September 6, 1875, by the Sisters of the Holy Cross.

On the arrival of the Sisters of the Holy Cross to take charge of St. Mary's Academy, and before opening school, Father Scanlan was petitioned by prominent mining men to establish a hospital for the benefit of miners and men working in the smelters. The result of a conference between Father Scanlan, Marcus Daly (then in charge of mines at Ophir), Fred Meyer, a prominent smelterman of Sandy, and other mining men, was the renting of a building. In this building two Sisters of the Holy Cross began their work of charity November 26, 1875. After two years, the rented building was too small. To meet the increasing demands in 1880 the ten-acre block in Salt Lake City, on which the present hospital of the Holy Cross stands, was purchased, and the building of a new hospital commenced the same year. The new building was completed and ready for occupancy in 1882. In 1902 a new wing was added.



THE CATHOLIC CATHEDRAL

All Hallows College, which stands on the corner of Second South and Fourth East Streets, is another prominent Catholic institution. It was built in 1885, and in September, 1886, was opened as a boarding and day school. During the past eighteen years it has been one of the leading educational institutions of the intermountain States. In November of 1886 the news of Father Scanlan's appointment as bishop of Salt Lake was cabled from Rome.

Bishop Scanlan, that he might attend to founding other needed institutions

in his larger field of labor, in June, 1899, transferred All Hallows College to the Marest Fathers. After this Bishop Scanlan directed all his energies to the founding of an orphan asylum. In 1892 the residence which he occupied for three years at the corner of First South and Third East Streets was used for that purpose, and was known as St. Ann's Orphanage. The sympathy shown for the orphans materialized when Mr. and Mrs. Thomas Kearns gave $50,000 for the erection of an orphans' home. The new building is known as "Kearns' St. Ann's Orphanage." Six years before his death Patrick Phelan willed all his property, personal and real estate, for the support of the orphans. On the income of this property, Kearns' St. Ann's Orphanage now mainly depends for its support.

A home for aged and feeble miners, erected by Mrs. Mary Judge, will be placed under the direction and management of Bishop Scanlan, when completed.

This, with the new cathedral which is now being built, and which will be the finest and most substantial Catholic edifice in the West, occupying as it does perhaps the most desirable site in Salt Lake City, gives the Catholics in Salt Lake the most numerous educational and charitable institutions in the city outside of the Mormon Church.

Ogden has a new church which was opened for service in November, 1902. The first church was erected in 1876. The following year the Sacred Heart Academy was commenced and school opened in September, 1878. The old Sacred Heart Academy, which was used as a boarding and day school for fourteen years, was replaced in 1892 by a new substantial brick building.

Park City, the great silver mining camp of Utah, has a fine rock church edifice and day school for boys and girls. The first church was erected in 1880. This was burned in 1884, together with the school and pastoral residence, but all were replaced the same year by the present substantial buildings.

In Eureka, another rich mining camp of the State, a church was built in 1885. In 1891 a school was built. This school, conducted by the sisters of the Holy Cross, was opened in September of the same year.

Castle Gate, a coal camp on the Rio Grande Western Railway, has a church and resident priest.

Briefly summarized, since Bishop Scanlan took charge of Catholic interests in Utah in 1873, under his guidance and immediate supervision, twelve churches have been built. He was the founder of four hospitals, two academies for young lady boarders, one college, seven parochial schools, one orphanage, and a home for aged miners. In all his works he was encouraged and often substantially aided by all classes, whilst his conservative and prudent course has won for him the esteem and good will of all who know him.

The Presbyterian Church in Utah.—Rev. Henry Kendall, D. D., secretary of the board of home missions, in 1864 preached the first sermon in Salt Lake City that was preached by any representative of the Presbyterian Church. Rev. Sheldon Jackson, D. D., Synodical Missionary, landed at Corinne in June, 1869. Regular religious services were commenced on the 13th of June, and on the 14th day of July, 1870, the first Presbyterian church was organized in Utah.

The First Presbyterian Church of Salt Lake City was organized November 12, 1871. Later churches were organized at American Fork, Pleasant Grove, Ogden, Kaysville, Logan, Smithfield, Hyrum, Springville, Spanish Fork, Mt. Pleasant, Ephraim, Manti, Salina, Richfield, Parowan, Nephi, Payson, Benjamin, Central Park in Ogden, Brigham and Collinston. The Westminster and Third Churches in Salt Lake City have been added to the above list. Presbyterians now have twenty-seven churches in Utah.

Educational work, under the care of the Presbyterian Church, was commenced in Salt Lake City by Prof. J. M. Coyner April 12th, 1875. That beginning has

developed into the present Salt Lake Collegiate Institute. A few weeks later another school was opened at Mt. Pleasant, and is now the Wasatch Academy. Later another school was opened at Logan, which has now become the New Jersey Academy. The school that was organized at Springville has grown into the Hungerford Academy. The Presbyterian Church has now these four academies, educating about 500 pupils and fitting for college those that wish to pursue advanced studies. This educational work has been recently crowned by the founding in Salt Lake City of the Westminster College, by Rev. Sheldon Jackson, D. D. This institution is now prepared to take the graduates of the four above mentioned academies and give them a college course.

FIRST PRESBYTERIAN CHURCH - SALT LAKE CITY

Protestant Episcopal Church.—The Protestant Episcopal Church was planted in Utah in A. D. 1867 by Bishop Tuttle. In 1888 the Rt. Rev. Abiel Leonard became bishop. He died in December, 1903, and the see is now vacant.

St. Mark's Cathedral, in Salt Lake City, was built by Bishop Tuttle in 1870. The Very Rev. James B. Eddie has been dean since Easter, 1900. The parish possesses senior and junior branches of St. Andrew's Brotherhood and the Daughters of the King, and a flourishing Sunday school. St. Paul's Church, on Main Street, was built as a memorial about twenty years ago, and is under the care of the Rev. Charles E. Perkins. There are also two missions, St. Peter's, in the northwestern, and St. John's, in the southeastern, part of the city.

St. Mark's Hospital was organized in 1869 as the first hospital in the intermountain country. From the first it was well received. There are eighteen doctors on the staff, and a training school for nurses. It will accommodate about one hundred and fifty patients, and cares for over 1,600 a year. The work is

entirely supported by the earnings, and from what would be the profits, the charitable work is done. About four-fifths of the work is surgical.

Rowland Hall, the church boarding and day school for girls, was established in 1881. There are about 150 students. The certificate of the school admits to Smith and Wellesley Colleges.

In Ogden, the Church of the Good Shepherd is under the charge of the Rev. Alfred Brown, and has an efficient guild and a branch of the Daughters of the King. The church has missions at Provo, Springville, Plain City, Layton, Vernal and Logan, all being agricultural settlements, also at Park City and Eureka, mining camps. There is a missionary, Rev. M. J. Hersey, at Leland, Utah, who works chiefly among the Indians on the Ouray Reservation, occasionally giving a service at White Rocks on the Uintah Reservation.

The Methodist Church.—Methodism was introduced into Utah in December, 1869, by Rev. Lewis Hartsough. He continued in office until the summer of 1870, when Rev. G. M. Pierce became his successor and had charge of the work until 1876, when the mission was organized into a conference. In 1880 it was again made a mission, and in 1882 Rev. T. C. Iliff was made Superintendent, and this position he occupied until 1901. J. L. Leilich was then appointed and continued until December, 1903, and the position is now filled by Rev. H. J. Talbott.

The first church edifice was erected in Corinne in 1870. First Church, Salt Lake City, was begun in 1871. Methodism now has in Utah forty preaching places under the care of twenty-three pastors, with twenty-one church buildings and sixteen parsonages. The Woman's Home Missionary Society has eleven deaconesses, missionaries and teachers at work in the State, with five mission schools in operation.

There are five churches in Salt Lake City under the care of as many pastors. In addition to the English churches, there are thirteen places in which the Scandinavian languages are used.

Unitarian Society of Salt Lake City.—In November, 1890, the Rev. Samuel A. Eliot inaugurated a series of services, afterwards continued for several weeks by the Rev. T. B. Forbush, in the Salt Lake Theater. A permanent organization was effected February 24th, 1891, and the Rev. David Utter was called to the pastorate. In November, 1894, Mr. Utter resigned, and was succeeded by the Rev. Stanley M. Hunter, who acted as pastor until the end of June, 1895. The Rev. Adelbert L. Hudson was then called. The Ladies' Society—the so-called "Unity Circle"—was organized. A Sunday school was built up, a Sunday school library of 500 volumes being purchased. After Mr. Hudson's departure at the end of 1897, the members in attendance declined, and by the close of 1899 meetings were entirely suspended. In the winter of 1901 the Rev. P. I. Thatcher came from Boston to see if the society could not be reorganized. A reorganization was effected and Mr. Thatcher was engaged as the regular minister of the society. Mr. Thatcher resigned in December, 1902, but was immediately succeeded by the Rev. William H. Fish, Jr. It was decided to undertake the erection of a building. Subscriptions were solicited, a non-interest bearing loan was secured, a building lot purchased, and a building completed November, 1903, at a cost of nearly $16,000, including the lot.

Christian Scientists.—Christian Science work in Utah was begun in Salt Lake City in the year 1888. In 1889 Mrs. Laura Lathrop, of New York City, visited Salt Lake and taught two classes in Christian Science. In 1890 Mrs. M. A. Bagley, of Montrose, Colorado, located here, and the next year, August, 1891, organized the first Christian Science Church in Utah.

In 1898 the church purchased a lot and erected the present church edifice,

which is worth about $35,000. The church has 400 members with a congregation of about six hundred. The Sunday school has eighteen teachers and about one hundred and forty children under fifteen years enrolled.

Christian Science work in Ogden was organized in May, 1892. It now has sixty-two members, with a congregation of about one hundred. It owns its church property, which is valued at $35,000, and is free from debt.

There are Science services in six other towns, as follows: Provo, Park City, Mercur, Milford, Vernal and Springville, and there are one hundred practitioners of Christian Science in the State.

Baptist Church.—Baptist work began in Utah in 1880, by the organization of a Sunday school in Ogden by H. A. Lindley. In 1881 a church was organized there by Dr. Dwight Spencer. Soon after, Dr. Spencer organized the First Baptist Church of Salt Lake City. There are now eight churches with 806 members. The churches are as follows: Bear River Valley; Ogden, O. C. Wright, pastor; Salt Lake City, First, D. A. Brown, pastor; East Side, Frank Barnett, pastor; Calvary, C. O. Boothe, pastor; and there are churches at Murray, Provo and Springville.

There is one mission in Ogden and two in Salt Lake City owning good properties. In addition there are regular preaching stations as follows: Thistle, Eureka, Price, Helper, Castle Gate and Scofield. Baptists own church property to the amount of $80,000, on which there is only $1,500 mortgage indebtedness. The Woman's Baptist Home Mission Society of the West sent missionaries at an early date and now supports seven in Utah. The Baptists are now spending $15,000 per year in evangelistic work in Utah.

The Central Christian Church.—This church was organized in April, A. D. 1890, in Salt Lake City, Utah. In June of the same year Elder W. F. Cowden, superintendent of Missions for Disciples of Christ, came here and preached for the church until August of that year. The American Christian Missionary Board selected and sent to this work October 1, 1890, Rev. B. F. Clay, who began his pastorate in October, 1890.

During the spring of 1892 a lot was purchased on the corner of Fourth South and Third East Streets. On July 1, 1893, the erection of a church was commenced which was completed that year, as was also an eight-room two-story brick parsonage on the north end of the lot.

The present membership is about 240, with Brother W. H. Bagly in charge. The value of the real estate, church and parsonage is now about $20,000, with an indebtedness to the church extension board of a little over $4,000.

Reorganized Church of Latter-Day Saints.—The Reorganized Church of Jesus Christ of Latter-Day Saints has been represented in Utah since 1863. There have been many branches or local organizations of that church in different parts of the territory and State since then, but a tendency to emigrate from Utah eastward as soon as embracing this faith has always kept their local membership down to a small figure. At present they have branches and church buildings at the following places: Salt Lake City, church building 228 East Second South Street; Ogden, church building, 1501 Washington Avenue; Provo, church building, 214 West Fourth South Street; Pleasant Grove; Union Fort Branch meets at the private residence of James Wardle; meetings are also held at West Jordan.

Utah forms a part of what is known as "The Rocky Mountain Mission."

The Congregational Church.—This church is an important one in Utah. It has congregations and church property in various parts of the State, chiefly in Salt Lake City, Ogden, Logan, Provo and Brigham.

The Lutheran Churches—English, Swedish and German—are well represented in Utah. They have some valuable church real estate. The English

Lutherans have a very pretty little church and parsonage centrally located in Salt Lake City, and the same can be said of the Swedish and German Lutherans, who have a church between them. Outside of this city these churches have congregations in some of the State's principal cities and mining camps.

The Seventh-Day Adventists are also in Utah. In Salt Lake City they have just completed a new chapel, where services are held every Saturday morning. This church controls also a pure food depot in Salt Lake, and it has branches in Ogden, Provo, Springville and in other sections of the State.

The Salvation Army is fixed in Salt Lake City and other populous centers, and is prominent in charitable movements.

Young Men's Christian Association.—The Salt Lake City Young Men's Christian Association was organized in May, 1890. It has a building under construction for its permanent home on the corner of State and First South Streets. It will cover a lot 91x129½ feet. The building will be of gray stone and red brick and fire proofed throughout, and is to cost $93,000, exclusive of site, which is one of the choicest in the city.

The funds for the enterprise have been provided by private subscription. Provision is made for all the features of Y. M. C. A. work, particular attention having been given to the educational and physical equipment. Plans are being completed for the launching of a complete night school upon the opening of the building. Three separate bath and locker rooms are provided, each opening into a magnificent swimming pool. The gymnasium is to be large, airy and well ventilated. Its equipment will be first-class, and includes an auditorium that will seat 500. Separate and complete quarters for the Boys' Club have an entrance on First South Street, the main entrance being from State Street. Living rooms for seventy-five young men are to be provided, in accordance with the most approved Y. M. C. A. arrangement.

Jewish Churches.—There are two Jewish synagogues in this city, one representing the reform and the other the orthodox wing of the Jewish religion. The name of the former is Congregation Bnai-Israel, and that of the latter Congregation Montefiore. The membership is over ninety, and the congregation is in good circumstances. Information regarding Congregation Montefiore may be had from Mr. William M. Levy, president of same, No. 266 State Street.

Charities

Utah is rich in charities. For its own people the Church of Jesus Christ of Latter-Day Saints has divided the State into "stakes," and again subdivided these stakes into ecclesiastical wards, each of which is presided over by a bishop with two counselors. It is the duty of these presiding bishops to keep in close touch with the members of their respective wards and to know the temporal needs of all persons in that ward. In this the bishops are assisted by the Teacher's Quorum and the Woman's Relief Society, organizations complete in themselves, and forming a part of the working machinery of each ward. The teachers form a body of male members of the church who make frequent house to house visits, to ascertain the spiritual and temporal condition of each individual. In this way the indigent are found out and reported to the bishop, who sees that relief is promptly forthcoming.

The Woman's Relief Society is organized into stakes and wards, and their especial mission in life is to care for those in need. The ladies of these organizations meet together at stated times to discuss and provide ways and means of reaching the destitute, and, like the teachers, they appoint members to go from house to house, investigating the temporal needs and wants of all. Women often find

distress where men could see none, and then, too, they are naturally more efficient as ministers to the sick and needy than are the men. They provide, often through the medium of sewing circles, clothing and bedding for those who want; they nurse the sick, close the eyes of the dead and pour balm into the hearts of the bereaved.

A unique and interesting feature in the charitable work of the Mormons is the fast-day offering. The first Sunday of each month is observed as a fast day throughout the church, when all the "saints" congregate in their ward assembly halls and donate the food saved by fasting, or its equivalent in cash, to the support

THE JUDGE MEMORIAL MINERS' HOME

of the indigent. These donations, or offerings, are taken in charge by the ward clerks and afterwards turned over to the bishops, who see to their proper distribution among those most urgent in need.

Salt Lake City has thirty-three ecclesiastical wards. This means that the city's poor is looked after by thirty-three bishops, assisted by sixty-six counselors, and thirty-three quorums of teachers and thirty-three woman's relief societies. The indigent of all classes and creeds, in so far as they will accept, are looked after in this way. The only questions considered in this matter is the urgency of the appeal, the true temporal condition of the case reported.

The Catholics of Utah have done much in the cause of charity, and they are constantly widening their sphere of usefulness in this respect. This church controls the Kearn's St. Ann's Orphanage, an institution which is at once one of the city's best and most useful ornaments. It is one of the imposing structures of "Zion," and was endowed by Senator and Mrs. Thomas Kearns, who gave $50,000

to its foundation, and who have since contributed generously to its support. At present the orphanage is a home for one hundred and sixty children. The only conditions imposed restricting admittance are those of good morals and the need of the institution's benefits.

Another Catholic charity which promises much to the State is the Judge Miners' Home and Hospital. This magnificent institution is most grandly situated on the east bench, overlooking Salt Lake City and the entire valley. It was built to perpetuate the memory of the late John Judge, one of Utah's most successful miners, by his wife, Mrs. Mary Judge, at a cost in excess of $100,000, and it will largely be supported by her munificence.

The Children's Aid and Home-Finding Association of Utah is a non-partisan and non-sectarian organization, whose object is the providing of family homes for homeless children. The association is incorporated under the laws of Utah, and its mission is "to protect children from cruelty, and to provide for the care and control of neglected and dependent children; to maintain one or more institutions or receiving homes for the temporary care of such children as may come under the supervision of the association; to secure family homes for homeless children, and to look after and protect their interests in such homes, etc." At present the association maintains one receiving home, and is under the superintendency of Mrs. V. A. Stickney. The association is supported entirely by public charity.

In addition to this there are St. Mary's, St. Mark's and Latter-Day Saints Hospitals, all situated in Salt Lake City, and all more or less supported by aid of charity.

It is needless to state that the Salvation Army in several Utah towns, as elsewhere, does much for the amelioration of many otherwise practically outside any charitable assistance. This does not include the work of charity carried on in almost every populous center by fraternal and similar organizations throughout the State. Many of the churches conduct charitable work at other points than Salt Lake, reference to which is made under the article on churches.

Mental Hospital

The State Mental Hospital is at Provo, Utah. It snuggles close to the hills and occupies one of the most restful and charming spots to be found in the Rockies. This institution is modern and up-to-date. The hospital has in the neighborhood of three hundred patients, some ninety per cent. of whom are pleasantly employed about the grounds. A list of things made in the wards includes such items as aprons, bed ticks, curtains, underwear, dresses, sun bonnets, etc., and in glancing over the list of farm products raised and consumed in one year, such items as the following are found: Watermelons and cantaloupes, 1,000 tons; apples, 250 bushels; cabbage, 9,600 pounds; strawberries, 2,000 quarts, etc. The institution is maintained by State appropriation.

Clubs and Societies—Fraternal and Otherwise

In Utah there are clubs, associations and fraternal orders practically without number, devoted to almost every conceivable purpose. Almost every fraternal and labor organization in the Nation is represented in this State. Woman's clubs and men's clubs; clubs literary and political; clubs for pleasure, and clubs or organizations devoted to work and the advancement of the State, and clubs that have succeeded in combining both pleasure and work to a high and pleasing

degree. The following list is compiled merely for the purpose of furnishing addresses for those who are desirous of communicating with the leading clubs:

The Alta Club, the oldest social club in Salt Lake City, owns a magnificent gray stone club house on the corner of State and South Temple streets. Its membership numbers many of the State's financial, social and political leaders.

The Commercial Club. Commercial Club Building, Salt Lake City, an organization of representative business men who meet socially and seek fundamentally to

A GLIMPSE OF FORT DOUGLAS, SALT LAKE CITY

advance the material interests of this great inter-mountain country, with special reference to Salt Lake City.

The Country Club, whose beautiful homelike surroundings are found on the southeast bench of Salt Lake City, 945 East Eleventh South Street. Here are golf links, tennis courts, and other features conducive to the social pleasures of its members.

The University Club, Salt Lake City, is now occupying its new home, one of the handsomest club buildings to be found in the West.

The Weber Club, Ogden, Utah, a strong organization of the leading social, business and political men of Utah's second city.

The Commercial Club, of Provo, has for its existence the same objects as control its namesake of Salt Lake City.

JORDAN RIVER.

SCENE IN CITY CREEK CANYON

CITY CREEK CANYON

Scenic Attractions—Resorts

UTAH is the panoramic State of the Union, the treasure house of nature, the wonderland of the world.

Here mountains wear their diadems of glittering snow the year round, and near their tops are crystal lakes alive with trout and fringed with trees, hemmed in by precipitous cliffs on one side and rolling meadows on the other. In the ages long since dead these rugged mountains were tortured, twisted and rent until their frowning faces became seamed with deep gorges and canyons in which, to-day, are found thousands of little nooks and dells where people go in summer to rest from the turbulent world and its torrid heat, and, forgetting their cares and anxieties, renew their friendship with nature. Romance dwells in these mountains. The rocks and trees, the dizzy, awe-inspiring cliffs where eagles build their clinging nests; the grass carpeted retreats where summering parties pitch their tents along the noisy mountain streams rushing on their ways to the valleys and farms below; the natural table lands standing thousands of feet above the sea, gorgeously clothed with wild grasses and flowers; the narrow trails leading, now through obscuring patches of grass or dense timbers, now along the bald face of some giant precipice commanding distant views of civilization's outposts; the call of birds for their mates, the occasional bleat of mountain sheep and low of gentle cattle, the scream of eagle by day and the hoot of owl by night—all these combine to make attractive the natural retreats of this State.

An hour's drive from almost any city in Utah will bring one in close touch with mountain scenery as bewitchingly enchanting, or as grand and awe-inspiring as any in the old world. Ogden Canyon, Provo Canyon, the Cottonwood Canyons, Parley's Emigration, American Fork and Logan Canyons are rich beyond conception in scenic attractions, and scores of summer resorts in these and other canyons of the State are simply unsurpassed in those features conducing to the rest, the health, the happiness and the uplifting of the race.

Utah, mountain-walled, lake-begemmed, stream and river laced, is the pleasure and health seeker's paradise. Nowhere are skies of deeper blue. No country has greater charms or more varied attractions; nowhere is nature more lavish in her blessings to man, or more beautiful to look upon than here, where crags and peaks push their caps of eternal snow into the skies, where hill and dale, valley and vale, teem with agricultural and mineral wealth, and where cities, towns and hamlets, as beautiful as dreamland and pulsating with energy derived from the best mountain climate on earth, snuggle in the laps of hills, in bowers of vines and fruit trees. Go north, go south, east or west in this State and at every turn, you will find one of nature's scenic triumphs, one or more of her great masterpieces. England has nothing like them. Switzerland, with her famed Alps, mirrored in bewitching lakes, cannot stand comparison with Utah in scenic attractiveness. The dreary valleys of the Nile were never as entrancing as those of the Jordan in Utah, and no country drained by Danube, Rhine, Elbe or Spree was ever blessed with so many of nature's riches as the valleys of Cache, Utah, Salt Lake and Weber.

Some Mountain Resorts

Park City, Utah's most famous mining camp, should not be overlooked by the tourist. From Salt Lake City the shortest route is via Parley's Canyon, which is

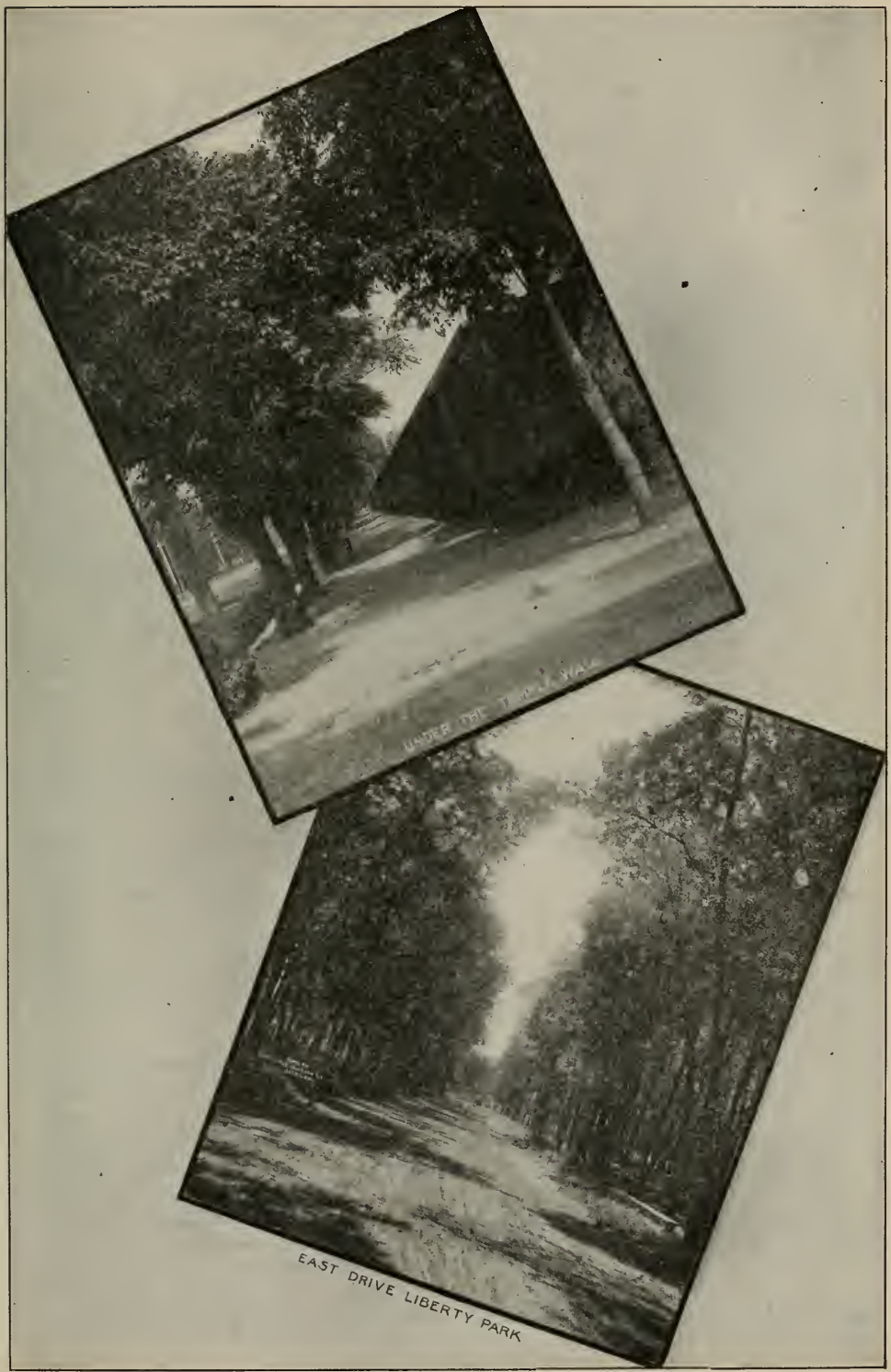
traversed by the Park City Branch of the Rio Grande Western Railway, passing such mountain retreats and resorts as "Pharaoh's Glen," a shady nook on a trout-filled stream ten miles from Salt Lake City; "The Old Arm Chair," three miles farther on from "Pharaoh's Glen" and in the very fastnesses of the great Wasatch range. Here are 100 acres of cool, shady groves and miles of winding woodland lanes. "Mountain Dell," "Felt's Resort," "Half-way House," "Barclay," "Gorgorza"—all mountain retreats—and then Park City, the home of the Ontario, the mine which has paid more dividends than any silver-lead mine in the Rocky Mountains. Here also are the Silver King and Daly West mines, all in a prosper-

BRIGHTON—A SUMMER RESORT NEAR SALT LAKE CITY

ous, mountain-walled city of cheerful and well cared for homes, schools, churches and hotels.

Some nine miles from Park City and 9,000 feet above sea level is "Brighton's," a delightful resort in the tops of the mountains surrounding "Silver Lake." Near by are "Lake Mary" and "Lake Blanche." Accommodations here include a good hotel and cottages for rent. Saddle horses and burros may be hired, and hunting, fishing and mountain climbing indulged in to the heart's content. From "Brighton's" one may reach Salt Lake City through Big Cottonwood Canyon, which is one of the most grandly picturesque in the world, and which furnishes a number of superb camping sites for those who have the time and inclination to "live by the way."

But from Park City there are other interesting routes by which we may return


EAST DRIVE LIBERTY PARK

to Salt Lake City, and one of the most pleasing of them is by stage, horseback or bicycle, as one may elect, over a fine road with a heavy down grade to Heber City, a distance of about fifteen miles.

Heber City is an Arcadian village in one of the most picturesque valleys in the world. Three miles farther on is Midway, where is located the famous "Hot Pots," where there is a comfortable bathing establishment. Here also is a good hotel, dancing pavilion, etc. From Midway the route is by rail through the celebrated Provo Canyon (than which none is more beautiful) to Provo City, by the shore of Utah Lake, and then up the valley of the Jordan. The railroad follows the windings of the Provo River from Heber City to its mouth, and in doing so passes many charming nooks and camping sites, under frowning peaks and along sides of crystal pools abounding in speckled trout as toothsome and gamey as were ever caught. The "Bridal Veil Falls" in Provo Canyon are passed on this trip, as are also "The Forks," one of the most popular resorts in the country. Then follow "The Falls," below "Bridal Veil Falls" and eleven miles from Provo, said to be the most beautiful spot in the canyon, and "Carter's," where one may fish and take trout dinners in a country hotel that is celebrated for them; and many other places where to linger in the summer time is nothing if not joy.

Emerging from Provo Canyon we are on the shores of Utah Lake—Utah's Sea of Galilee—where it must ever be a pleasure to live. Fishing, yachting, swimming, boating—these are among the sports and pastimes to engage the attention. We are now forty-seven miles south of Salt Lake City, to reach which we traverse valleys whose actual wealth seems fabulous and which are threaded by the Jordan as it unites Utah's Gallilee to Utah's Dead Sea.

Another famed mountain retreat is "Wasatch," high up in the granite hills of Little Cottonwood, some eighteen miles from Salt Lake City. In the summer time the trip to this spot is a splendid drive, and one that is greatly in favor with prominent families of Salt Lake City. It was in this canyon the rock for the famous Salt Lake Temple was quarried. From Wasatch there is a train road to Alta, an old and rejuvenated mining camp, with an elevation of 9,000 feet. A three-mile tramp from Alta will bring one to "Brighton's," passing the bewitching lakes previously spoken of.

Prominent among the attractions in suburban Salt Lake City is Fort Douglas, at the foot of Red Butte, kept fresh and delightful by the waters from Red Butte Canyon. This is a full regimental post, and was founded by General Patrick Edward Connor in 1862, now being extensively bettered. The fort is grandly situated, and should be visited if for no other reason than the view it commands of the surrounding country. Salt Lake City, the Great Salt Lake, island dotted and shimmering in the distance, the Oquirrh Mountains with their feet bathed in the lake which, stretching south, make a dividing wall between Salt Lake and Tooele Counties, the silver thread of the Jordan with its verdant fringe, the great smelters, towns and villages stretching to the south, the State penitentiary and the hoary peaks of the Wasatch—all are stretched out before Fort Douglas, a panoramic view as entrancing as the world contains.

Calder's Park and the Salt Palace are two suburban pleasure resorts that enjoy great popularity during the summer months. These grounds are beautifully laid out and the entertainment afforded at these places is exceedingly varied. All these attractions are in close touch with the heart of Salt Lake City by electric cars. Mention should also be made of Liberty Park—the Tier Garden of Zion—practically a gift from Brigham Young to the city. At "Agricultural Park" the State Fairs are held each October, when many thousands of the faithful come from all points of the compass to attend the great semi-annual conference of the Mormon Church.

Ogden Canyon, though one of the most romantic and beautiful to be found anywhere, with its magnificent drive and beautifully retired inns, is almost as widely known for its splendid power plant situated at its mouth. This is but a few minutes' drive from the city of Ogden and about forty miles from Salt Lake City. If you pass the "plant" and follow the bend of the river, you will see how the canyon narrows, and you will marvel at its sublime beauty. The roadway is of the best and a drive to the "Hermitage," seven miles up the canyon, or the "Oaks,"

A STRING OF BATHERS

still two miles further, where rest and refreshments may be had, is one of the most delightful attractions this State has to offer. Passing still further up, perhaps two miles more, the canyon widens out into a charming amphitheater, appropriately called Eden Valley, in which happy and prosperous farmers make their homes.

Great Salt Lake

Who has not heard of America's Dead Sea—the mystery-shrouded Great Salt Lake? Its fame has reached every corner of the civilized world, and its waters, clear as crystal, and holding in solution more wealth than the total assessed valuation of the whole United States, charm and bewitch tens of thousands of people each year. This is one of Earth's wonders. Think of a sheet of water having an area of 2,700 square miles, standing over 4,000 feet above sea level, possessing no outlet yet constantly receiving the flow of four large rivers, and, notwithstanding the many millions of gallons of fresh water it receives each day in the year, remaining the saltiest body of water on the earth to-day. The Atlantic Ocean holds 3.5 per cent. of solid material in solution, Salt Lake has 24 per cent. of solids. The only other body of water in the world that can compare with this lake is the Dead Sea of Palestine, whose restless waves ceaselessly roll over ancient Sodom and Gomorrah. This Asiatic Dead Sea contains 23 per cent. of solids which includes less salt and soda than Great Salt Lake, but much more magnesia, calcium and potassium.

Hundreds of thousands of tons of salt have been produced on the shores of the Dead Sea in Utah by solar evaporation, and a little calculating will demonstrate to

the satisfaction of any one that millions, yes billions, of tons of salt are still held in solution by this inland sea. The contents of Salt Lake have been estimated at 1,505,433,600,000 cubic feet, and one-sixth of this, or 16⅔ per cent., or 250,905,600,000 cubic feet, is salt and sulphides of soda. Seven-eighths of this incomprehensible amount is salt, which weighs eighty pounds to the cubic foot, making the total number of pounds of salt in this lake 17,560,339,200,000, or 8,780,169,600 tons. If we figure the sulphide of soda down, allowing 50 pounds to the cubic foot, we find the lake contains 784,080,000 tons of it.

But as vast and amazing as the above figures are, it is as a health and pleasure resort that the Great Salt Lake is famous. No body of water in the world is more enchanting or ravishing in its beauty. The islands dotting this inland sea are as rich in color as the storied isles of Greece, and the awe-inspiring sunsets are worth a journey over seas and across continents to behold. Nowhere is the Great Artist of the universe more lavish with his blending and contrasting of colors—colors richer and more gorgeous than the wildest fancy of frenzied art can conceive. As the sun sinks in the West at the end of each summer's day, all the glories of the world past and present are reflected with exaggerated splendor in sky and lake and on mountain top.

But to experience a full measure of the ecstasy of these scenes, one should take a plunge into this wonderous water. The bathing is unsurpassed—it is not equaled in any clime. It is impossible to sink, so heavily charged is this water with solids in solution; and a common sight is to behold men calmly floating on their backs, without motion or effort of any kind, some of them smoking their cigars with as much comfort and ease as though at home and in their own drawing-rooms. This water, in which no animal life, visible to the naked eye, is found, seems full of life-giving energy. The most delightful sensations are experienced while bathing here, and one leaves the water greatly refreshed and invigorated, practically encrusted with salt, and marveling that so vast a body of water can have a temperature so high—above 80 degrees Fahrenheit all during the bathing season.

Saltair is the principal bathing resort on the lake. It is about twenty-five minutes' ride from Salt Lake City, via the Salt Lake and Los Angeles Railway, and from an architectural standpoint the Pavilion is the most imposing structure devoted to its purpose to be found anywhere. It is Moorish in style, with a great central dome like the roof of the famous tabernacle, and covers a perfect dream of a dancing floor 140x250 feet in dimensions. It was built over the water upon 2,500 ten-inch pilings at the end of a pier extending 4,000 feet into the lake, and at a cost of $250,000.

Lagoon.—At Farmington, a charming village some eighteen miles north of Salt Lake City, is a noted resort called "The Lagoon." It is reached by the Oregon Short Line; but is owned by the Salt Lake & Ogden Railway, which line in the summer months makes frequent trips between that delightful spot and Salt Lake City. It is planned during the present year to extend the line from Farmington on to Ogden, to change the motive power from steam to electricity, equip it with the most perfect cars made and give an hourly service between Salt Lake and Ogden, thus affording ready and frequent access to and from the resort for both those cities. The ride between Salt Lake City and the Lagoon is through the garden spot of the West, so ideally rural, so restful, so serenely beautiful that it may be doubted if its equal is to be found.

Mineral Springs.—Utah also abounds in mineral springs of widely varying thermic conditions. Perhaps those best known are the "Warm Springs" of north Salt Lake City, which have become famed for their medicinal qualities. "Beck's Hot Springs" are farther north—beyond the city limits—and here the mineral

impregnated waters boil from the living rock. Like the "Warm Springs" these are charged in nature's own laboratory with hydro-sulphuric acid gas and are found very beneficial in the treatment of all diseases that yield to thermal waters. There are ample accommodations at both these places, and waters from the "Hot Springs," having a temperature of 110 degrees F., are piped into the heart of Salt Lake City, where they may be enjoyed in all kinds of baths, Turkish, plunge or private, at the Sanitarium on Third South Street, between Main and West Temple Streets.

The "Utah Hot Springs" are eight miles north of Ogden, on the Oregon Short Line and Southern Pacific Railroads, where they are conducted in conjunction

LAKE MARY, COTTONWOOD CANYON

with a good hotel and a bath house ample and modern in scope and convenience. Sixty-one miles south of Salt Lake City, amid the crags of Spanish Fork Canyon are Castilla Springs, which are claimed to be almost identical in their curative properties, with those world famed ones of Baden, Germany. There are other medical springs in the State, including the "Hot Pots" of Heber. These are natural craters of heated water, and, in connection with the springs mentioned above, are destined to make this State one of the great sanitariums of America.

Climate

"Old Folks' Day" is observed in the several communities in Utah without respect to any particular day. It is set apart as occasion seems to warrant, and

the "old folks" are made guests and everything done that can minister to their pleasure and comfort by those younger than themselves and who have that reverence for age which is the one superlative mark of a good heart and gentle breeding. On these days dancing, foot racing and other sports, generally associated with the pleasures of youth, are indulged in by men and women over 60, 70 and 80 years of age, and prizes are awarded to the winners, as also for other conditions peculiar to age. The sight of these aged ones on such a day would satisfy any beholder that the declaration of one person over 70 years of age, that every inhabitant of Utah considered it "a duty to live beyond 70 years" was not only a purpose in life, but was possible because of all conditions, climatic among others.

The peculiarity of all higher latitudes in the Rocky Mountain regions is the absence of that atmospheric humidity which makes heat at lower altitudes unbearable in summer and the cold in winter well nigh unendurable. The evaporation from the 2,500 square miles of Great Salt Lake, and of Utah, and other lakes in the State, without destroying the bracing and invigorating effect, still tempers the aridity to a point that affords absolutely perfect climatic conditions.

There exists all through Utah that change in seasons so indispensable to the highest sense of seasonable enjoyment and to longevity of life. In summer, cool nights, when blankets are absolutely necessary, may be had by a few minutes or a few hours drive from any populous point. At no time in the habited parts of the State is there such excessive warmth of summer or cold of winter known as in the Eastern or Northern States. The winters are cool and bracing, the spring weather mild and pleasant, the summers warm, yet not enervating, and the falls are invariably a long stretch of Indian Summer,—the most delightful of all seasons,—with a temperature just right for the acceleration of the blood, yet not cold enough to cause discomfort.

The average rainfall in Utah is from 10 to 20 inches. The greater rainfall is in the mountains where the moisture condenses more quickly and is heavier than in the valleys.

In 1903 there were 201 cloudless days in Utah; 92 days were partly cloudy, and only 72 cloudy days.

The average mean temperature of the State is 47.3. The annual relative humidity is 51 per cent.

The climatic conditions are ideal to people who enjoy the four seasons tempered by sunny skies and gentle breezes from mountain tops.

Financial

THAT Utah is destined to assume a high position financially, not only as regards the West, but with respect to the nation at large, even a superficial acquaintance with the extent and variety of her resources will make plain. Any one of several resources would be sufficient to win for her wide material recognition and add incalculably to the nation's wealth, but when many such are found within her borders the assurance of high rank in the nation as a wealth producer is an irresistible conclusion. Last year she stood fourth as a producer of precious metals, and the development of these are but in their infancy. Her iron deposits are most extensive, and, omitting geographical considerations, the most valuable known in the world. Her coal fields are practically limitless and inexhaustible. Her hydrocarbons are unrivaled on earth, both as to extent and quality, while the chemic value of the minerals held in solution in the Great Salt Lake are beyond computation. That these may profitably and economically be worked, the presence of agricultural areas equal to any rational demand, gives abundant assurance. Not one in ten thousand of Utah's inhabitants has any conception of the State's resources or of the high commercial and financial future that awaits her at an early date as a result of their possession.

FRANK KNOX
President and Organizer National Bank of the Republic

Utah has always occupied a financial position to be envied by the most prosperous and substantial States in the Union. Yet not until the depression of 1893 had she obtained any material prominence as to her stability, though the credit of her people long before then had been well established and ranked with the very best. Utah is perhaps the only State in the Union of which can be said that, during the panic of 1893 and subsequent periods of financial distress, there was not a single bank failure; while the proportion of failures among the business houses and other industries, as a result of the depressing conditions both East and West, was very small indeed. The reputation gained by the absence of bank failures in 1893

has been maintained, and it may be safely said that no State in the Union holds to-day a general higher credit than that of Utah.

The development of the banking interests has been rapid of late years, especially in districts outside of Salt Lake City. Populated in the main with an economical and conservative people it necessarily follows that a bank to be successful must be controlled and officered by men of widely recognized means and probity of character. And that such a condition prevails is, with very rare exceptions, an undisputed fact, as is shown by the public confidence manifested in these institutions.

W. S. McCORNICK, OF McCORNICK & CO.

So is this true of the larger and more widely known wholesale and retail houses. Zion's Co-operative Mercantile Institution does a business aggregating close on $4,000,000 annually, and has a pay roll of $20,000 per month. The jobbing trade of Salt Lake City is estimated to exceed $35,000,000 annually. Necessarily, as the leading city of the State, the bulk of domestic manufactures are centered in Salt Lake, and her banks show the trade conditions by the deposits. McCornick & Co. have deposits of over $5,000,000, while those of the National Bank of the Republic, of which Mr. Frank Knox is president, exceed $3,000,000.

It has been characteristic of the people of Utah to make haste slowly. While there is a repugnance to all boom movements as ephemeral and dangerous, there is, nevertheless, a serious desire for as rapid a growth as may be consistent with safety. Hence it comes that there is a steady gain from year to year—in population, wealth, manufactures and values generally. This applies to the whole State. Perhaps the credit of no State is higher when it comes to the loaning of outside money on farms and productive property; and it may be doubted if any losses are yet to be recorded—values never having gone generally so high on farm properties as to give room for a recession that would cause general losses to the mortgagee.

In mining returns especially Utah stands without a rival. No State in the Union has paid so much in return for the money invested in this industry—so generally considered hazardous. And this reputation is constantly being augmented at a ratio which increases with every year. But this subject is treated in detail elsewhere. Suffice it to say that while much of the money to develop Utah mining properties has been furnished by Utah banks, the returns have helped incalculably to swell the holdings of the banks—and each has prospered by the other.

Banks in this State are divided into three classes, Private, National and State. The first is not subject to examination, the second is subject to National examination, and the third to State inspection.

The total capitalization of the banks of the State amounts to $4,407,893; the total resources equal $59,311,567.34; the commercial deposits aggregate $27,032,721.92; their savings deposits amount to $7,702,835.78, while they have a surplus and undivided profits amounting to $13,491,285.65.

PRIVATE BANKS	Capital Stock and Surplus	Surplus and Undivided Profits	Resources	Deposits
McCornick & Co.	$250,000	$50,000.00	$5,851,251.84	$5,108,186.00

NATIONAL BANKS	Capital Stock	Surplus and Undivided Profits	Resources	Deposits
The National Bank of the Republic	$300,000	$122,422.00	$3,726,857.02	$3,004,434.80
First National, Brigham	30,000	2,719.00	198,186.07	157,966.10
First National, Logan	50,000	19,429.57	387,310.51	305,380.14
First National, Murray	25,000	1,231.22	63,157.87	26,926.65
First National, Nephi	50,000	106,070.80	300,949.90	94,377.12
First National, Ogden	150,000	73,245.15	1,693,303.19	1,199,135.31
Commercial National, Ogden	100,000	23,653.73	840,486.31	650,685.27
Utah National, Ogden	100,000	29,487.47	661,521.04	414,969.12
First National, Park City	50,000	50,264.28	859,183.65	708,919.37
First National, Price	50,000	4,836.17	160,068.97	48,607.48
Commercial National, Salt Lake	200,000	25,690.84	1,331,192.04	804,982.26
Deseret National, Salt Lake	500,000	492,641.36	3,554,571.49	1,446,374.96
Utah National, Salt Lake	100,000	3,831.75	563,232.21	273,628.48

STATE BANKS	Capital Stock	Surplus	Resources	Deposits
Bank of American Fork	$ 40,000	$ 18,288.43	$ 325,662.78	$ 264,910.29
Bank of Brigham City	50,000	11,051.26	255,863.27	186,481.85
Bank of Heber City	22,893	1,723.73	88,891.31	63,054.20
B. H. Schettler	5,000	196.23	103,877.03	95,120.25
Barnes Banking Co.	25,000	34,946.40	165,723.90	103,135.50
Davis County Bank	25,000	9,988.59	104,106.90	63,574.35
Deseret Savings Bank	100,000	97,271.68	1,993,562.09	1,796,290.41
Hammond Banking Co.	10,000	1,935.39	121,780.30	59,844.91
Lehi Commercial and Savings Bank	50,000	2,751.99	173,209.69	116,246.05
Manti City Savings Bank	50,000	33,033.6-	273,370.47	163,403.71
Mount Pleasant Commercial and Savings Bank	50,000	23,732.67	253,771.88	177,896.23
Ogden Savings Bank	75,000	25,877.51	763,954.16	650,540.65
Ogden State Bank	100,000	24,597.15	888,919.85	704,185.51
Provo Commercial Savings Bank	100,000	21,107.07	570,077.78	448,552.92
Richfield Commercial and Savings Bank	25,000	4,151.60	106,803.58	76,998.53
Springfield Banking Co.	50,000	469.96	190,916.41	140,366.45
State Bank of Provo	25,000	3,002.01	63,794.68	35,767.67
State Bank of Utah, Salt Lake	250,000	71,807.64	1,482,124.77	779,973.03
Thatcher Bros. Banking Co., Logan	150,000	23,940.97	750,145.34	571,405.00
Utah Commercial Savings Bank, Salt Lake	200,000	13,857.77	703,061.35	446,640.62
Utah Savings and Trust Co., Salt Lake	150,000	35,650.12	823,813.98	617,796.19
Walker Bros., Bankers, Salt Lake	200,000	35,000.00	1,506,069.00	1,243,655.69
Wells, Fargo & Co's. Bank, Salt Lake	500,000	11,994,999.10	23,082,834.10	8,615,315.79
Zion's Saving Bank and Trust Co., Salt Lake	200,000	48,758.03	3,578,038.04	3,315,186.30

Railroads

FOR over a third of a century Utah has enjoyed railroad facilities east and west, making her the pioneer of all the Far West States in this important factor in civilization, as she was the actual pioneer in the reclamation of the arid West. Brigham Young and the Mormon people not only built, owned and operated the first railroad in Utah, the old Utah Central and its extensions (now a part of the great Oregon Short Line system), but it was entirely due to their efforts and influence that the Pacific railroads were completed as early as they were and rail connection between the Missouri River and the coast established. Labor was scarce in those days and the Mormon people furnished it. They made the grade, cut the ties and delivered them, and laid the rails. The Indians through Wyoming and west into Nevada were hostile and resisted the encroachments of the steam horse. Brigham Young and the Mormon people, by the most pacific measures, neutralized this hostility from the eastern boundaries of Wyoming to the center of Nevada, and the great work of building the railroad from east to west was pushed, protected and advanced by the efforts and influence of the Mormons. Mormon people not only welcomed the advent of the Pacific railroads, but they were a decidedly important factor in their construction. To them, too, is due the credit of building, owning and operating the first branch from the main line between Omaha and Oakland—the old Utah Central above referred to.

THE LATE GEORGE W. THATCHER

It was in 1869 that the Utah Central reached Salt Lake City. Its line from Ogden to Salt Lake is now the initial point in Utah of the Oregon Short Line, the continuation of which from Ogden, Utah, to Butte, Montana, was projected and partly built by John W. Young, oldest living son of Brigham Young. It was completed into Montana under the direction of, and afterwards operated by, the late George W. Thatcher, a son-in-law of Brigham Young.

The completion of the Utah Central into Salt Lake was only the beginning of the work of the Mormons in railroad construction. Within a year active con-

struction was in progress on a line of 105 miles to the southward, which had its corporate existence under the style of the Utah Southern. Its completion was the signal for another advance, and the Utah Southern Extension was built to Milford and Frisco, 137 miles farther. This last piece of railroad construction made possible the magnificent development of the great Horn Silver mine at Frisco. These latter two extensions are now the nuclei of the great San Pedro system, which Senator W. A. Clark of Montana, with his associates, is now building, and which, within a year, will make Salt Lake City and Los Angeles—the City of the Saints and the City of the Angels — less than twenty-four hours apart.

W. H. BANCROFT.
Vice-President and General Manager Oregon Short Line System

It is significant of the progress made by the Mormon people in early railroad construction that ten years after the junction of the Union Pacific and Central Pacific Railroads at Terrace, Utah, they had built and in operation, a north and south line 363 miles long, extending from Franklin, Idaho, almost to the southwestern boundary of Utah. Three years later, under stimulus of Union Pacific officials, they had added 350 miles more and extended the line into Garrison, Montana. By this time a narrow gauge line sixteen miles long and connecting the mines of Bingham with the valley smelters had been built by non-Mormon capital and brains, but up to the advent of the Rio Grande Western into Utah in 1882, the bulk of the railroad mileage in Utah, Idaho and Montana had been built and was at that time operated by the Mormon people. With the exception of the sixteen miles noted it had all been projected, financed and constructed by Brigham Young, John W. Young, John Sharp, George W. Thatcher and W. W. Riter, all prominent men in the Mormon Church.

John W. Young then took up the important work of constructing feeders for the main lines in Utah, and successively built the Utah Western to Garfield Beach and began work on the Utah Central, which was to run to Park City and the coal mines of Grass Creek and the Weber and on to the timber lands of the Uintah Mountains. The first is now the main line via the Leamington cut-off of the San Pedro, Los Angeles & Salt Lake Railroad, which came into existence in July, 1903. The Utah Central is now an important branch of the Rio Grande system.

The building of this latter great system from Colorado into Utah, in 1882,

afforded the State its first railroad competition. No sooner had this line effected a terminal at Ogden than it began and has ever since maintained a systematic development of the natural resources of Utah. It has opened the greatest coal fields in the West and has extended its markets to the coast of Asia.

The last dozen years have seen the construction in Utah of numerous short lines calculated to stimulate the development of the State or to make its resources and attractions more easy of access. Among these are the Salt Lake & Los Angeles, to Saltair Beach; the Salt Lake & Mercur, giving traffic accommodations to the great cyanide gold camp of Mercur; the Salt Lake & Ogden, penetrating the rich fruit and garden region north of Salt Lake; the San Pete Valley, connecting with the San Pedro at Nephi and extending into the valley of the same name, "The granary of the South."

I. A. BENTON,
Passenger Agent Denver & Rio Grande Western R'y.

The railroads of Utah have kept fully abreast of the big systems of the country in the aim for physical perfection that has been so marked a policy for years past. Grades have been improved, the lines laid with heavier rail, and new, modern equipment substituted. Some of the changes designed to shorten mileage and reduce curves are radical in their extent. Chief among these must be rated the Ogden-Lucin cut-off of the Central Pacific—a railroad across the Great Salt Lake—by which a saving of thirty-three miles and the elimination of practically all grades was effected. The next in importance was the widening of the gauge of the old narrow gauge from Salt Lake to Garfield and the continuation of the line around the westerly base of the Oquirrh range to a connection with the old line of the San Pedro at Lynn Junction. This is to be the picturesque main line of the San Pedro from Salt Lake to Los Angeles, and, skirting the south shore of the great lake, as it does, its attractions will be important. Other heavy reconstruction and new construction is the big Salina cut-off on the Rio Grande Western and the building by the same company of a line through the picturesque canyon of the Provo, up to Heber City, in Wasatch County.

Nor is it alone in the possession of constructed lines that the State is so well provided. The limitless natural resources of the region call for more lines, and exigencies of the great railroad interests of the country demand that additional local and through lines be built in and through the State. Of those projected, one, the San Pedro, popularly known as the "Salt Lake Road," is now actually operating 520

miles in Utah and Nevada, and is pushing construction at a rapid rate from its present terminus in Nevada and from its eastern terminus in California. Within a year the connection will be made and the immediate result will be a twenty-four hours' service between Salt Lake and Los Angeles. In addition, the road will open an immense mineral and agricultural country through Nevada and southern California.

A projected and partially constructed trans-continental line through Utah is the Moffatt Road, the new short line from Denver to Salt Lake, and what is beyond question its continuation, the Western Pacific from Salt Lake to San Francisco.

The conditions related go to show that while Utah antedated all the mountain States in the construction and operation of railroads, the lines now in existence are but nuclei of vaster systems. As to the advantages the State offers for the exploitation of new lines, the wonderful mineral resources, now undeveloped for lack of transportation facilities, would be sufficient to cite. But there are stock, sheep and agricultural interests that would also be stimulated by new railroads. That Salt Lake City is a natural railroad center and destined to become a great railroad center can be demonstrated by a few figures. The total mileage within the State is 1875. The total mileage operated from within the State is approximately 4,000. On these are running 388 locomotives and 9,523 cars, and the lines extend through Utah, into Colorado, Wyoming, California, Nevada, Idaho, Oregon, Washington and Montana, nine of the greatest of the mountain States. From Salt Lake City are operated lines that cover the water sheds of the great basin, the Colorado River and the Gulf of California, the Columbia River and the Pacific, the Missouri River and the Gulf of Mexico. They extend from near the tropical to far north of the temperate zone.

NAME OF COMPANY	Total Mileage	Ass'ed Value of Property (Including rolling stock, franchises, supplies, telegraph lines, buildings, etc.)
Rio Grande Western Railway Co.	769.62	$6,781,034
Oregon Short Line Railroad Co.	574.44	5,089,676
Central Pacific Railway Co.	186.66	2,161,117
Union Pacific Railroad Co.	98.54	1,187,232
Utah & Pacific Railway Co.	78.12	432,830
Echo & Park City Branch U. P. R. R. Co.	36.49	207,700
Sanpete Valley Railway Co.	56.91	149,633
Salt Lake & Ogden Railway Co.	20.43	102,994
Salt Lake & Los Angeles Railway Co	14.98	95,300
Salt Lake & Mercur Railroad Co.	13.03	77,775
Grass Creek Terminal Railway Co.	5.	12,600
New East Tintic Railway Co.	2 51	13,955
Ogden & Northwestern Railroad Co.	6.88	7,815
Copper Belt Railroad Co.	....	5,300
Ogden Union Railway & Depot Co.	7.	207,170
Totals	1,875.61	$16,532,131

With such a start and with the development of the West only really beginning, the likelihood of Salt Lake City becoming one of the great railroad centers of the Union is at least equal to that of any other Western city.

The adoption of a new operating policy by the management of the Union Pacific and Southern Pacific Companies late in March emphasized more than any preceding event the strategic importance of Salt Lake City as a railroad center. This was the erection into general operating divisions of the line of the Union Pacific, the Southern Pacific and subsidiary lines, and the appointment of a general manager over each of these great divisions, these to report to Julius Kruttschnitt,

at Chicago, who has the title of Director of Transportation. Under this arrangement A. L. Mohler became vice president and general manager of the main line of the Union Pacific with headquarters at Omaha; W. H. Bancroft, vice-president and general manager of the Oregon Short Line, with headquarters at Salt Lake, and his jurisdiction extended eastward to Green River, Wyoming, on the Union Pacific and westward to Reno, Nevada, on the Southern Pacific; E. E. Calvin, vice-president and general manager of the Oregon Railroad & Navigation Company, with headquarters at Portland, Oregon.

While the redistricting of the lines adds to the mileage that will have Salt Lake City as headquarters the source of greatest satisfaction to Salt Lake and the railroad world of Utah is the recognition of the merits of Utah railroad men in the appointment of the general managers.

Street Railways

The first street railway to begin operations in Utah was projected and inaugurated by John W. Young, son of President Brigham Young, the pioneer. Its motive power was the mule, electricity then being an unknown quantity in motive power as applied to rapid transit. The Mormon Church was heavily interested and for years encouraged the enterprise, and only disposed of its interest when the church property was taken into the hands of a receiver. That street railway line was the forerunner of Salt Lake's present extensive system of rapid transit by electric power.

At the present time there are really but two street railway systems in Utah—the Utah Light & Railway Company, which operates all the street railways in Salt Lake, and the Ogden Rapid Transit Company, which operates in Ogden. The West Side Rapid Transit Company, however, operates 6¼ miles of electrical road in Salt Lake and into the adjacent territory to the southwest. This line has a favorable outlook for substantial extension in the near future.

The Consolidated Railway & Power Company, of Salt Lake, has 37 miles of single and 19 miles of double tracks. The assessed valuation of the mileage, rolling stock and other items is $469,373. This system covers the city pretty thoroughly, and runs south to Murray, near the smelters, over eight miles distant, and penetrates the populous portions of the district built up southeasterly of the city proper. It also gives quick and frequent connections with Fort Douglas and the several cemeteries and some of the pleasure resorts.

The Ogden Rapid Transit Company operates eight miles of electrical lines, which run through the principal portions of Ogden City and to the Union Depot. They also pass Glenwood Park and connect with a steam line that runs from the end of the electric line to the Hot Sulphur Springs, some eight miles north of Ogden. The assessed value of the Ogden electrical system, including mileage, rolling stock and all other items, is $49,320.

The assessed value of the West Side Rapid Transit Company's property, inclusive of all items, is $17,750.

The Salt Lake & Suburban Railway has a franchise from Salt Lake south a distance of some twelve miles, and part of the work has already been done.

The Utah Light & Railway Company has a franchise and during the summer will extend its line from Murray south to a point east of Bingham Junction, and thence west to Bingham Junction, a distance of about five miles.

The Salt Lake & Ogden Railway, now run by steam and operating between Salt Lake and Farmington, in Davis County, is to be converted to an electrically motived line and extended to Ogden some 18 miles beyond, and 38 miles north of Salt Lake, and for the principal portion of the day an hourly service between these cities is projected.

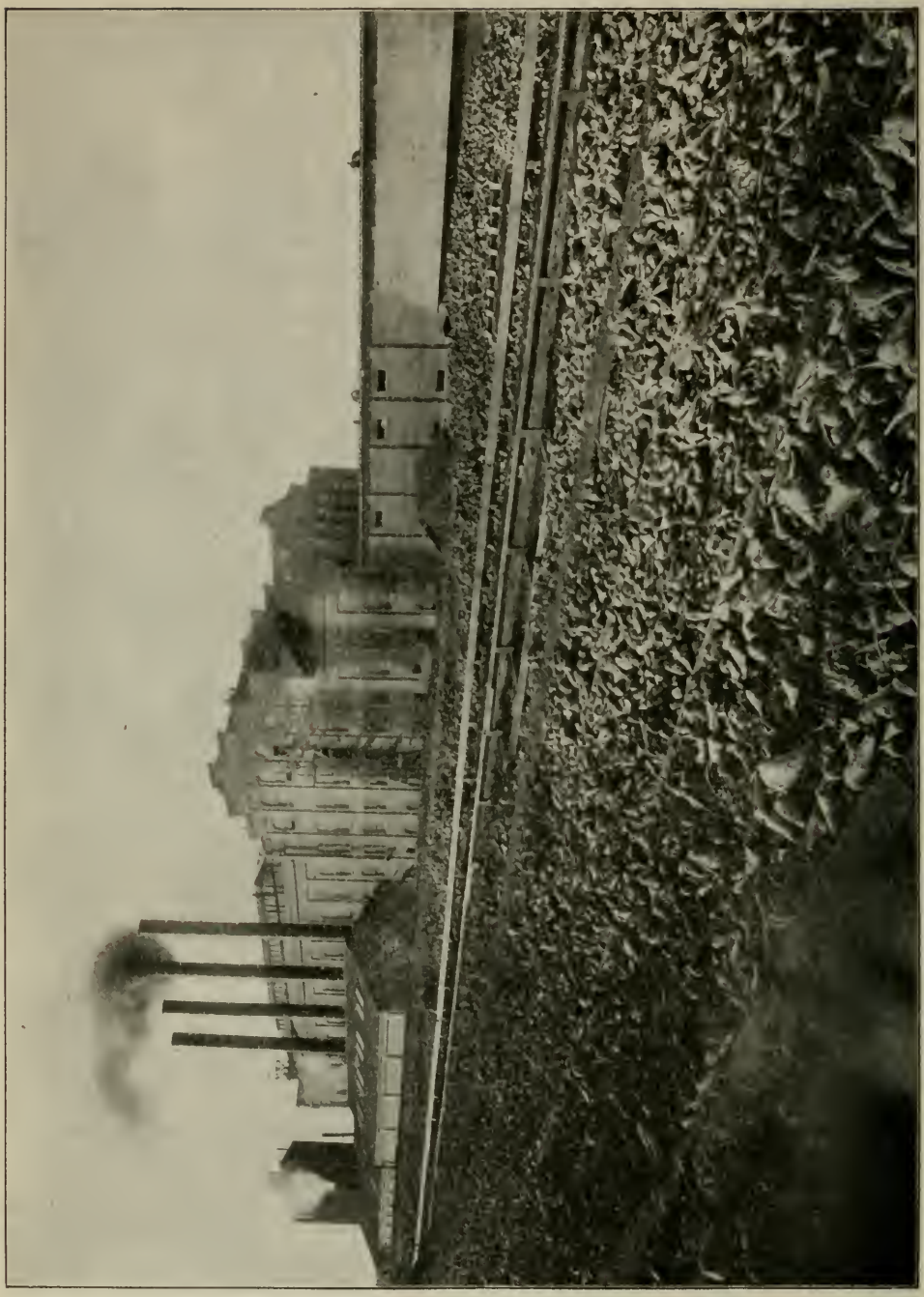
Industries

Manufactures

THAT Utah does not occupy, as a manufacturing center, a position infinitely in advance of her present status, is due to absolutely insuperable obstacles. The inauguration and support of home manufactures has been a cry in the Salt Lake Valley as old as its occupancy by white men. The spirit of self-support sprang both from patriotism and necessity. Beginning the subjugation of limitless solitudes and disheartening wastes 1,000 miles from contact with the outer posts of civilization, with almost impassable mountain ranges and trackless and waterless wastes intervening, that only might be had which the hands of those toiling in the Salt Lake Valley produced. From the beginning "home manufacture" has been the one common impulse of pioneer and pioneer's child alike, and those living long in this State have listened to the support of home industries as the burden of many a mighty discourse from Mormon pulpits.

So it came that in early days woolen factories were established in Salt Lake Valley, in Washington County—the southernmost county in the State—in Utah County at Provo, in Ogden, at Brigham City in Box Elder County, and elsewhere. Also cotton was raised in the southern part of the State and a factory for the manufacture of cotton goods established. At a later date strong effort was made to encourage the raising of cocoons and the manufacture of silk. This will account for the numbers of mulberry trees to be found throughout the State, these having been planted for the purpose of feeding the silk worms with leaves therefrom. While the industry has not prospered in proportion to the enthusiasm with which it was introduced, it has not been abandoned and its future importance and value to the State is recognized by State aid in suitable form. Two conditions are, however, indispensable to successful manufacturers on an important scale. These are a population great enough in numbers and sufficiently congested, and transportation facilities to enable the manufactured article to be taken within reach of the consumer. Marked as the growth in population of Utah has been, it has failed to keep up with the ambition of her people as to manufactures; and it may be said without fear of successful contradiction that railroads have not befriended local manufactures. Prior to the organization of railroad corporations with extensive mileage within this State, the long haul was sought for, and all the influence and backing of railroad corporations whose mileage covered the State and the territory that should have been tributary to it for geographical reasons, was exerted in favor of the manufacturer outside of the State. Hence many industries that would have grown, and which were entitled by all normal conditions to successful development, were destroyed through railroad friendship for foreign as against domestic products. Despite this some have grown, though many have been destroyed utterly.

After years of struggle and losses and patriotic support by stockholders, the Provo Woolen Mills have become a dividend paying proposition, and are to-day competing successfully with the product of greater manufactories of the east. These mills use nothing but Utah wools, last year consuming 850,000 pounds. They employ steadily some two hundred employes, whose wages aggregate approximately $50,000 annually. These mills produce blankets, linseys, all varieties of



UTAH SUGAR FACTORY

flannels, ladies' cloths, fancy cashmeres and tricots. The fancy cashmeres and tricots are sent largely to the Eastern markets. The value of the mills' annual product is approximately $225,000, and of this sum $150,000 is shipped to Eastern markets, while the balance is domestically consumed. The product for the present year will be increased fully 25 per cent., which will involve an increase of 25 per cent. in the amount of wool to be purchased by the mills.

The large and modern shoe and overall factory of Zion's Co-operative Mercantile Institution is another illustration of a successful manufacture despite Eastern competition. In 40 minutes from the time its building is commenced a shoe is turned out finished in this factory. The establishment is perfect in all its appointments. The value of its product in 1893 was $125,000 in shoes, and $100,000 in overalls—a total of $225,000. These goods are sold all through the inter-mountain region in competition with Eastern products of a like nature. The shoe and overall departments employ steadily 175 persons, and the annual wages paid exceed $80,000. The officers of this institution, which does an annual jobbing and retail trade in general merchandise equal to some $4,000,000, are: President, Jos. F. Smith; vice-president, George Romney; secretary and superintendent, T. G. Webber; treasurer, A. W. Carlson.

Silver Bros., of Salt Lake City, give employment to something in excess of 100 persons in their foundry, where they compete with Eastern iron manufacturers in many branches.

Manufacturing establishments in the State number 1,565; they own real property to the value of $6,530,000, and personal property valued at $12,575,000. The value of the manufactured product is $30,275,187 annually. This does not include smelter productions, the coke product, the beer product, nor several others of importance. The value of the sugar product from the Utah beet is over $2,000,000 annually. The value of the State's coke product is close to $150,000 annually, and this coke is from Utah coal. The list of manufacturing industries include the following items, and the number of establishments is given as nearly as may be: Awnings, 4; bicycle repairing and manufacturing, 21; blacksmithing and wheelwrighting, 191; boots and shoes, custom work and repairing, 80; boots and shoes, factory product, 6; bread and other bakery products, 29; brick and tile, 49; carpentering, 43; carpets, rags, 3; carriages and wagons, 9; cars and general shop construction and repairs by steam railroad companies, 10; cheese, butter and condensed milk, factory product, 73; clothing, men's, custom work and repairing, 62; clothing, women's, dressmaking, 28; confectionery, 24; dyeing and cleaning, 5; electrical construction and repairs, 6; flouring and grist mill products, 80; foundry and machine shop products, 15; fruits and vegetables, canning and preserving, 8; furniture, cabinet-making, repairing and upholstering, 19; furniture, factory product, 7; hand stamps, 3; hosiery and knit goods, 10; leather, tanned, curried and finished, 4; lime and cement, 8; liquors, malt, 7; lock and gunsmithing, 7; looking glass and picture frames, 8; lumber and timber products, 81; lumber, planing mill products, including sash, doors and blinds, 28; marble and stone works, 20; masonry, brick and stone, 22; mattresses and spring beds, 4; millinery, custom work, 52; mineral and soda waters, 8; monuments and tombstones, 15; painting, house, signs, etc., 29; paperhanging, 13; patent medicines and compounds, 5; photography, 43; plastering and stucco work, 70; plumbing and gas and steamfitting, 37; pottery, terra-cotta and fire clay products, 7; printing and publishing, book and job, 18; printing and publishing, newspapers and periodicals, 62; roofing and roofing materials, 5; saddlery and harness, 55; salt, 5; sewing machine repairing, 4; slaughtering and meat packing, wholesale, 5; slaughtering, wholesale, not including meat-packing, 3; sugar and molasses, beet, 4; tinsmithing, coppersmithing and sheet iron working, 38; tobacco, cigars and cigarettes, 15; trunks and valises, 3;

watch, clock and jewelry repairing, 46; woolen goods, 6; all other industries, 80. The latter embrace agricultural implements; baking and yeast powders; baskets, and rattan and willow ware; bookbinding and blank book making; bottling; boxes, cigar; boxes, fancy, and paper; brooms and brushes; cars and general shop construction and repairs by street railway companies; charcoal; china decorating; clothing, men's, factory product; coffins, burial cases, and undertakers' goods;

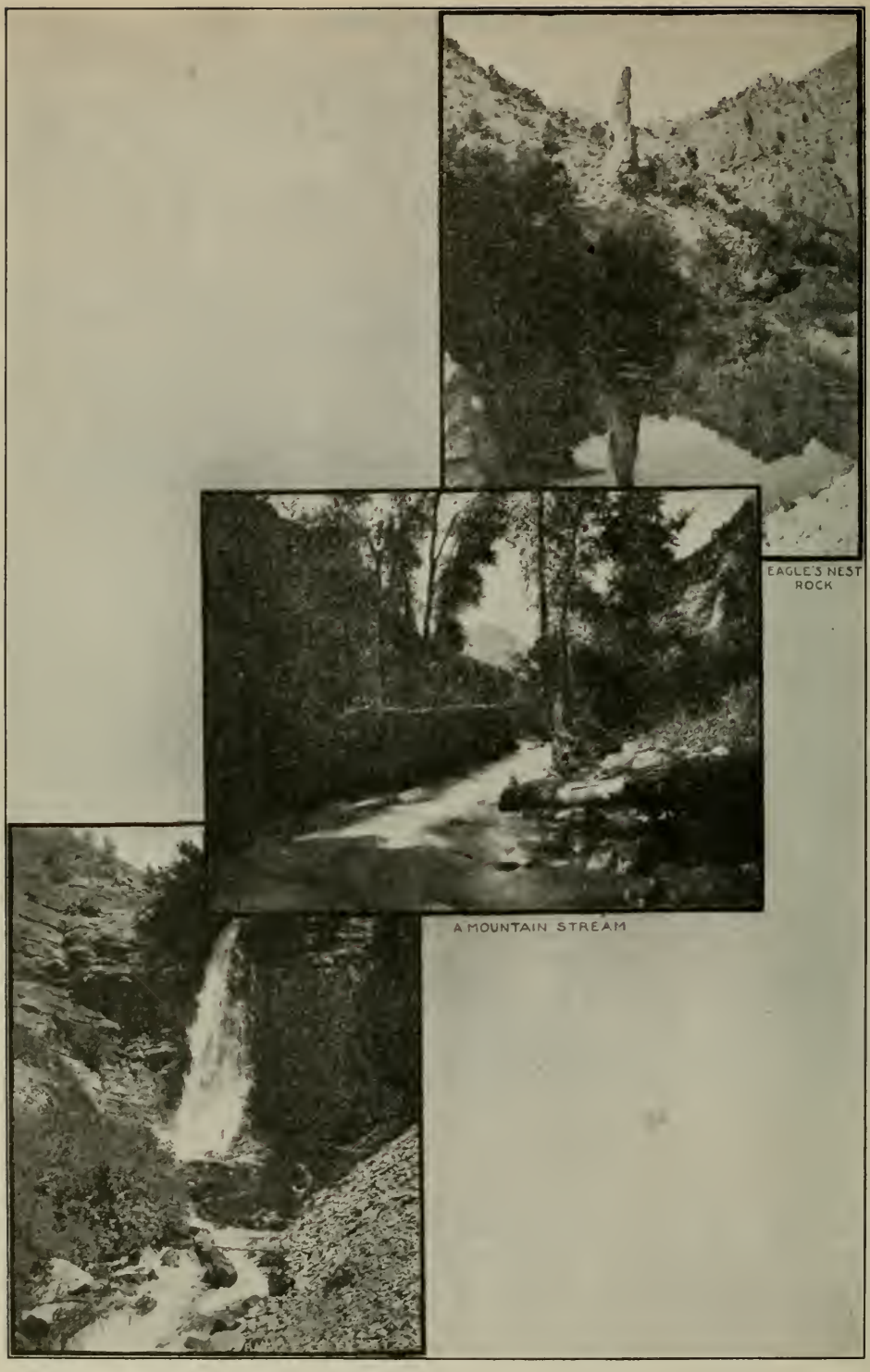
DESERET NEWS BUILDING, SALT LAKE CITY

coke, copper, smelting and refining; engraving, steel, including plate printing; flavoring extracts; fur goods; furnishing goods, men's; gas, illuminating and heating; gloves and mittens; hair work; ice, artificial; ironwork; architectural and ornamental; jewelry; lead, bar, pipe, and sheet; lead, smelting and refining; oil, not elsewhere specified; optical goods; pickles, preserves and sauces; rubber and elastic goods; scales and balances; shirts; show cases; silk and silk goods; soap and candles; taxidermy; typewriter repairing; vinegar and cider; whips; wirework, including wire rope and cable; wood, turned and carved and wool pulling.

Water Powers

While the development of cheap power in this State has followed rather than encouraged the growth of demand, it has materially added to the saving and materially encouraged many industries that were formerly severely handicapped in the struggle for success. Within ten years wonders have been worked in the State through the utilizing of waters formerly thought to have no value save for irrigation. Thousands of miles of electric wires are strung over the State, and the current therefor is supplied by power from the mountain streams before they are diverted and run on their way to make glad the thirsty earth with their refreshing wealth and life-giving fluid. Especially valuable has the introduction of this force been in furnishing power for street and residence lighting in Salt Lake, Ogden, Provo, Logan and other cities, and for the operation of electric street railway lines in Salt Lake City. One of its most significant values, however, has been in supplying power for mining operations at points where the price of delivering coal from the railroads made the line between working at a profit or at a loss so uncertain as to take away that assurance which is the incentive to labor. Of course, no such power developed by water is yet employed in mining as is consumed in the operation of street railways and street and house lighting, but the development of this resource, while really wonderful in the past decade, has only begun. Ere long every one of the mountain streams, and there are hundreds, will be made to furnish electrical power without in anywise decreasing the value or volume of water for irrigation. And when most, if not all, of these streams can be utilized several times because of their rapid fall, some wide idea may be had of the vast possibilities this new and inexhaustible field affords for the supplying of unlimited power by electrical development at a nominal figure. What this means to manufacturers cannot be over-estimated—what it means to the development of mining districts remote from coal may be conjectured only. It is utterly impossible to give any idea of the ultimate power that may be developed from this source; but it is estimated that there is at present 25,000 undeveloped horse power tributary to Salt Lake alone, and when the storage of water proposed and soon to be inaugurated, and referred to in the article on "Irrigation," shall have been accomplished, the maximum of possible power will always be maintained, and the present maximum incalculably increased.

What is known as the Utah Light & Railway Company has for nearly ten years been engaged in the development and acquisition of water powers. This corporation not only lights Salt Lake City and Ogden, but controls all street railway systems of Salt Lake, furnishes power for smelters south of Salt Lake, and for manufactures, elevators and similar purposes in Salt Lake. As fast as can be done with safety it is replacing its steam with water power, though its object is always to have on hand a steam plant capacity that will never fall below 33⅓ per cent. of the demand made upon it for power. Two seasons of the year there are at present when steam power is necessary to augment the power developed by water. These are from June 15th to September 15th—the irrigation season—and during parts of the months of December and January when extreme cold diminishes the natural water flow. This latter difficulty has in a measure been overcome by that company securing the output of the power plant of the Utah Sugar Company on Bear River, which, with the present installation and that to be put in during the present year, will give 4,500 horse power beyond question in the winter months, since the length of the Bear River and the great volume of water it carries frees it from the effects of extreme cold to which the smaller streams are subject. The Utah Light & Railway Company supplies a maximum power for its own purpose in lighting the streets of Salt Lake and Ogden, and in operating the street railway



BATTLE CREEK FALLS, AMERICAN FORK CANYON

system of Salt Lake, and for manufactures in Salt Lake and vicinity, of 9,000 horse. The average horse power demand is 5,000. To meet this and growing conditions it has a steam plant of some 5,000 horse power; it has 5,000 horse power installed at Ogden in the pioneer power plant; it has 4,500 horse power from Big Cottonwood and 2,500 horse power from the Utah Sugar Company's power plant (leased for six years) on Bear River—in all 17,000 horse power, of which 12,000 is developed by water. This must be understood as the maximum power that can be developed with existing installation, though at given seasons of the year the volume of water would furnish power infinitely greater. Added to the 17,000 horse power given should be the 2,000 additional to be put into the Bear River plant the present year. The officers of the Utah Light & Railway Company are Joseph F. Smith, president; John R. Winder, first vice president; Joseph S. Wells, second vice president. These, with A. H. Lund, W. S. McCornick, W. J. Curtis, L. S. Hills, A. W. McCune and W. P. Read form the directorate. R. S. Campbell is secretary and general manager and L. S. Hills, treasurer.

CASCADE—COTTONWOOD CANYON

The Telluride Power Company is another large corporation also actively engaged in the development of water power systems for creating electric currents. It has a plant of 2,500 horse power in Logan City, Cache County, developed on the Logan River. The power unnecessary for lighting purposes in Logan is transmitted south to the mines in Tintic Mining District—150 miles—and is used for power at intervening points. On the Provo River it has a plant which will be in operation by June of this year with an installed maximum capacity of 10,000 horse power. This power is sent to the mines of Tintic, Bingham and Mercur, and is utilized at intervening points. The same company is also installing a plant on the Beaver River, in Beaver County, in the southern part of the State, which will have a capacity of 3,000 horse power, and will be used by the mines and kindred industries of Beaver and contiguous counties. This will give the Telluride Power Company a maximum power capacity equal to 15,500 horse. It already has 350 miles of poles and about 1,500 miles of wires in the State. Its system is a double circuit. These wires are of seven strand aluminum and have a line voltage of 40,000 volts. Its officers are: James Campbell, of St. Louis, president; Ralph King, Cleveland, Ohio, vice president; H. R. Newcomb, Cleveland,

Ohio, secretary and treasurer; L. L. Nunn, Telluride, Colo., general manager; P. N. Nunn, Niagara Falls, chief engineer.

The Columbus Consolidated Mining Company is now finishing a plant that will develop in Little Cottonwood Canyon some 700 horse power. This power will be used by the mine itself and will supply other mines in Alta with power. The intention is to increase it to a maximum of 1,000 horse power.

Besides this, American Fork, Pleasant Grove and Lehi are all supplied with street and household lights by electricity created by the development of something like 2,000 horse power in American Fork Canyon.

Beginning at the northern part of the State and going south the horse power developed by water at present, and certain to be developed during the present year, is substantially as follows:

Logan City Corporation, present installation, Logan River	1,000 H. P.
Telluride Power Co., present installation, Logan River	2,500 H. P.
Utah Sugar Company, present installation, Bear River	2,500 H. P.
Utah Sugar Company, to be installed this year, Bear River	2,000 H. P.
Brigham City, two plants, present installation, Box Elder Canyon	2,000 H. P.
Utah Light & Railway Co., present installation, Weber River	5,000 H. P.
Utah Light & Railway Co., present installation, Big Cottonwood River	4,500 H. P.
Salt Lake City Water & Electrical Power Co., present installation, Jordan River	1,500 H. P.
Utah County Power Co., present installation, American Fork River	2,000 H. P.
Telluride Power Co., present installation, Provo River	10,000 H. P.
Telluride Power Co., to be installed this year, Beaver River	3,000 H. P.
Columbus Consolidated Mg. Co., to be in operation May 1st, 1904, Little Cottonwood	700 H. P.
All others, present installation	2,000 H. P.
Total installation	38,700 H. P.

These plants all develop electrical power. In every part of the State, for flouring mills and other minor manufacturing purposes, there are an infinite number of small water powers that are applied directly, but which in the aggregate will add vitally to the total horse power developed by water in the State, though it would be unsafe to make an estimate.

It is estimated that the average cost for the installation of a plant for the development of electrical power will equal $150 per maximum horse power. This would make the investment in the State for the development of this power equal to $5,905,000, and does not allow any value for the appropriation of water. No definite figure can be given of what this power is sold for. A conservative figure, however, under existing conditions, would be to place the income from the sale of power developed by water at $750,000 annually.

Sugar Industry

The estimated annual production of sugar in Utah is 25,000 tons. The estimated annual consumption is 10,000, leaving a balance of $15,000 tons to be exported, which may be said to command an average price of $90 per ton. The gross income, therefore, to Utah from sugar is $1,350,000—in addition to the $900,000 worth now produced and consumed in the State, all of which is saved as against a sum equal to $2,350,000 that formerly could not have been counted among the State's products.

The development of the sugar industry in this State is really phenomenal, and it shows what may be accomplished in other directions under energetic and intelli-

gent management, such as in later years has characterized the direction of this young and thriving industry. The present successful record must not be taken as an example of a continuous prosperity in this pursuit in the State. Very many residents of Utah will recall the dismay that faced those interested in the sugar industry in its earliest stages.

The first beet sugar factory in Utah began operations in Lehi, Utah County, December 26, 1889. The capacity was 330 tons daily. It was designed for a 300-ton plant, but as a bonus was given for all tonnage over 300 and up to 350, the contractors were well rewarded when, for each 24 hours, it handled 330 tons.

GATHERING SUGAR BEET SEED

Subsequently it developed a 400-ton capacity every 24 hours, which evidenced the greater efficiency and more intelligent management of operation. The 330 tons of beets which the factory originally handled produced about 725 sacks of sugar of 100 pounds each in the 24 hours' run. The present capacity of this factory is 1,100 tons of beets each 24 hours, with a product of 2,700 bags of 100 pounds each, a sugar product which has increased almost 50 per cent. above the production of earlier days from the same quantity of beets. Twice the factory has been enlarged, and now embraces three cutting stations and 42 miles of pipe line in Salt Lake and Utah Counties, with another cutting factory soon to be erected in Utah County, and ten miles of additional pipe line to be added.

This original factory was owned by the Utah Sugar Company, as it is to-day. The present officers of the Utah Sugar Company are: Joseph F. Smith, president;

Thos. R. Cutler, vice president and general manager. These gentlemen, with W. S. McCornick, John R. Winder, John Henry Smith, Heber J. Grant and John C. Cutler, constitute the board of directors. Horace G. Whiterey is secretary and treasurer. The personnel of this company is closely identified with the inauguration of the beet sugar industry in Idaho. Last year a plant was established at Idaho Falls, and ground has already been broken for another in Fremont County, both in Idaho.

Also at Garland, in Box Elder County, this State, a new factory has been erected by the Utah Sugar Company. The machinery now installed gives the plant a daily capacity of 600 tons of beets, but the Garland factory building has been constructed so large that the consumption of beets therein may be increased to 1,200 tons daily, by the introduction of additional machinery. When the factory is enlarged to its maximum capacity it will produce 3,000 bags of sugar daily during its 24 hour consumption of 1,200 tons of beets.

THOMAS R. CUTLER.
General Manager Utah Sugar Company

There are also other sugar factories at Ogden and Logan with a combined capacity of perhaps 900 tons of beets. The acreage necessary to the production of these beets and other items given elsewhere will apply to these factories as to those of the Utah sugar factories.

A factory is also to be established at a point known as Lewiston, in this State, about six miles south of the Idaho line, during the coming year, which will likely have a capacity of about 500 tons of beets daily.

As already intimated, the outlook in the earlier days, both for sugar beet raisers and for stockholders in the then new factory was dismal in the extreme. The plant at Lehi was the first in the inter-mountain region. The beet sugar industry was practically in its infancy in all parts of the United States. The beet crop, instead of being looked upon as a field one, was viewed as a garden product, and those who understood the cultivation thereof, not only so as to raise quantity, but so as to gain the maximum percentage of sugar in the beet, lived no closer to Utah than California. The result was that but 400 persons were employed in the cultivation of the 2,000 acres planted to sugar beets the first year, and the crop was light and the percentage of sugar so low that both farmers and manufacturers were discouraged. Now 1,800 farmers alone are engaged in sugar beet cultivation on the 4,000 acres of land in Utah and Salt Lake Counties that supply the Lehi

factory; and these, during the period of cultivation, employ practically one person to each two acres of ground in sugar beets, or more than double the number of employes per acre compared with the first year.

The average production of beets to the acre in Utah is over twelve tons; Germany's average is ten to eleven tons; Nebraska's, about eight tons; Michigan's, less than Nebraska, because of drouth or excessive rains; and owing to seasons of extreme drouth California's average is lower still. The percentage of sugar (or "polarization" as it is called) in Utah sugar beets is about 15½ to 16 per cent. Of course, the tonnage in particular cases, as well as the percentage of sugar to the ton, greatly exceed these average figures.

It must be borne in mind that the operating season of a factory in the Rocky Mountain region is approximately 100 days; and while there is practically no limit to the area that can be made successfully to produce sugar beets, these can be raised only at certain seasons of the year, and their perishable nature is such that they must be handled within 100 days or thereabouts, or chemical changes take place which destroy their value as sugar yielders.

The present estimated area devoted to the cultivation of sugar beets in Utah will approximate 35,000 acres, producing in round numbers 400,000 tons of sugar beets which yield in the neighborhood of 25,000 tons of sugar.

Ten years ago the remote hope of those fostering the sugar industry in this State was to make enough to supply Utah with half her own demand. Now she produces all of the 10,000 tons she annually consumes and 15,000 tons in addition.

Excluding clerks and like employes, the five beet sugar factories during the run of 100 days will pay out between $125,000 and $150,000 in wages.

The Utah Sugar Company owns a power plant near Garland, which is already installed and has a present capacity of 2,500 horse power. It is so constructed that this may be increased to 4,000 horse power, by the addition of very little machinery. This power is developed by water from the Bear River.

By-Industries and By-Products

It costs $450 for coal for every 1,000 tons of beets worked in a beet sugar factory in Utah, and this coal is mined in the State, so that the additional sum named may be credited to the successful operation of beet sugar factories in Utah.

Likewise, for every 1,000 tons of beets consumed, $100 in lime rock (for carbonizing or neutralizing the juices) is used, and as this lime rock is produced in Utah, the sugar industry is to be credited with its share of the lime rock mined in the State.

Food for Cattle and Sheep

Each factory yields in tons of pulp one-half the tonnage of beets worked. This pulp has been shown to have remarkable fattening properties for both cattle and sheep; and so the farmer who raises the beets may, if he desires, at a reasonable figure, buy back the pulp of his own beets and through it secure fat mutton and beef at a trifling cost. It is stated that the oldest sheep can, in six weeks' time, on this pulp, be made to taste like the tenderest and fattest of lambs. Stock raisers of Utah in earlier days, when desirous of fattening their own cattle for the market, were compelled to ship their live stock to the corn region of the East to secure fattening food; but since the value of the beet pulp has become known, much of that is done away with, and all parties concerned are advantaged. In this connection it should be made clear that this is an advantage peculiar to Utah and the inter-mountain region, because of the abundance of alfalfa, a very cheap

and prolific hay, and, as a cheap food, excellent in many respects almost beyond comparison. Each steer will eat 100 pounds of the beet pulp daily, besides 15 pounds of alfalfa. Without the hay the pulp is not effective, but with the alfalfa, the combination becomes an ideal fattener from every point of view for both cattle and sheep. One steer is equal to eight sheep from a feeding point of view.

It is also worthy of note that the advantage to the factories by the disposal of the pulp is nothing by comparison to the benefit accruing to farmers and sheep and cattle raisers, except that it rids the factories of a refuse that might otherwise be troublesome.

Other Products

Again, there is in the sugar vats a residuum, or low molasses product—left after all sugar that can economically be extracted has been taken out. This product may be utilized for three purposes, any one of which may be made valuable commercially. The first is to extract from the molasses a low product of alcohol, such as is employed in the manufacture of smokeless powder. The next is to convert part of the molasses residue into crystal, or potash salts. The third is to take the molasses and use it in conjunction with the inexhaustible quantity of fine coal dust that our coal mines are producing, and by combining them create coal brickettes—a fuel unsurpassed for many purposes.

Manner of Producing Sugar Beet Seed in Germany

In the fall of the year hundreds of acres of sugar beets, raised under the highest state of cultivation, are taken out of the ground and carefully examined by men trained to the business with a view to selecting and sampling. The leaves and crown of each well formed beet are first closely inspected for the purpose of ascertaining if its growth had been regular and if, while growing, it had been fully exposed to the rays of the sun. All beets passing this examination are separated from the great bulk of the product for a further examination. Their shape is next considered; and all that pass a successful examination as to leaf, crown and form are sent to the laboratory where a chemist's test is made of each individual beet as to saccharine matter; and out of these carefully selected beets all showing the highest degree of perfection are numbered and a complete record made of them. They are then placed in silos until the following spring, when they are again tested, and a comparison made with the former test. Those showing pronounced deterioration are thrown out. The balance are then photographed, and the photograph of each beet, together with its complete history, is then placed in what is called the pedigree book. The following year they are taken to the hothouse, where scientific methods are employed for the purpose of producing as much seed as possible from each individual beet. Here each beet is cut into slices from crown to root, and the slices planted in sand for sprouting. After all danger from frost is over the plants thus produced are transplanted in the fields. The plants produced from each individual beet are planted together in plats, and the plats numbered to correspond with the number of the beet in the pedigree book. This being done, wire netting is placed around and over the young plants to protect them from the ravages of animals and from hail storms, etc. During the season of growth they are closely watched and every symptom of disease checked, and in order to keep them healthy they are treated to several spraying baths composed of chemical mixtures. The seed produced from these plants is gathered, and that of each individual beet is kept separate until the next spring, when a small quantity of each beet is sowed in little plats; and the seed produced from this seed is carefully tested in the fall to ascertain its hereditary qualities; and all seed

failing to show that it has inherited all of the good qualities of its individual mother beet is cast out and destroyed, for a beet is of no value for seed purposes unless it possesses the peculiar quality of transmitting all its virtues to its posterity. The good and perfect seed is then sowed, and increased for three years, when it is sold to farmers who raise the sugar beets for the sugar factories.

A gentleman of our community spent some time recently in Germany and France, making a study of the raising of sugar beet seed, and the above is a brief summary of his observations.

Dairying in Utah

Dairying in Utah is confined to the valleys or irrigated districts, which are very fertile. In the early history of the State it was carried on to some extent on dry farms, but as such locations did not prove satisfactory or profitable, dry

A VILLAGE CREAMERY

farm dairying has been abandoned entirely. The dry farms produce coarse, dry herbage and are used almost entirely for wheat growing, while the irrigated sections produce abundantly of a great variety of small grains, grasses, clovers, fruits and vegetables. Lucern is the staple forage crop and does well in all parts of the State. It gives three cuttings a year, with a yield of about six tons per acre. When seed is wanted, only the first crop is taken for hay; the second goes for seed. This latter practice is common on the dry farms.

Lucern hay, in the populated sections near railroads, sells for about $3.50 per ton in the stack, while in outlying places away from the railroads, it sells for $2 to $2.50 per ton. As a single food for dairy cows lucern has no peer. Orchard grass, a well known and tried food, grows well with lucern and the two make a happy combination. The orchard grass is headed out and in bloom when the first cutting of lucern is made, but it does not amount to much in the second and third cuttings. As a single pasture crop, lucern is not satisfactory, as it causes great loss of animals through bloat. Permanent pastures, with a mixture of English rye grass, lucern, red clover, orchard grass, blue grass, oat grass and red top well manured and irrigated will return, with good cows, a net profit from butter fat alone as high as $50 an acre per year.

Utah is rapidly becoming a root growing State; as high as 30 tons of roots can be grown to the acre.

Mill feed is rather high in price, ranging from $15 to $25 per ton. On account of the high price not much grain is fed and it is very doubtful if another State, without feeding grains to its cows, can show as large a yearly record per cow as Utah. This is attributed to the sole use of lucern, which is much the same in composition as bran and to a certain extent is equal to bran pound per pound. The well developed light milking cow will do well on lucern without grain, but the heavy milker must have some, the amount of which will depend upon the milk flow and development of the animal.

The valleys of Utah afford ideal dairy conditions. The winters are mild and comparatively short, and the summer days, with cool nights, are pleasant. The weather is not extremely cold in winter nor hot in summer, as it is in the Northwestern States, as in Iowa, the Dakotas, Minnesota and Wisconsin. The climate is very equable and uniform. Winter temperature rarely goes below zero, cutting winds are rarely known, and costly barns are not needed.

Utah has 1,815 dairy farms, with a total of 159,773 acres. On these farms there are 15,000 dairy cows, which have a value of nearly $600,000. The dairy farms keep about eight cows each; this is low and is presumably due to the village system of farming. Nearly all the farmers live in villages and it may be said that Utah, aside from its mining interests, is strictly a rural community.

On 14,766 farms, not dairy, there are dairy cows. Counting range cattle, Utah has a total of 55,000 cows with an average of four to a farm for the whole State. The total value of dairy farm property, not including value of dairy cows, is $4,928,736. On the average dairy farm in the United States the value of live stock and buildings amounts to $676 and $1,190 respectively; while in Utah they amount to $550 and $535 respectively. The greatest lack is buildings.

Utah's annual production of milk is 216,000,000 pounds, from which are made 5,500,000 pounds of butter and 2,000,000 pounds of cheese. Of this 216,000,000 pounds of milk the factories work up about 80,000,000 pounds. There are about eighty factories in the State with a total value of $200,000, the most of which make both butter and cheese. With a mixed population such as Utah has, considerable butter and cheese are yet made on the farms, but the amount is growing smaller, and it is only a question of a short time when it will all be made at factories.

Cache County, in the northwestern part of the State, is the strongest dairy county. It has more than twice as many factories and milk producers as any other county. The factories in this county are the most modern, best equipped in the State.

Considerable change is taking place in the creameries, which are going from the central skimming system to the hand separator system. This change is not confined to Utah alone, but is general. By the hand separator system the milk

is separated on the farm and only the cream is taken to the factory. As high as $50,000 worth of hand separators were sold to Utah farmers in 1903. There are many advantages secured by the use of the hand separator, and good butter can be made by proper care of the cream. Nearly all of the creameries that run separators return the skim milk to the patrons. The price of whole milk at the factories depends upon the fat content, which, on an average, is 3.8 per cent.

There is a strong demand, with wages from $50 to $75 per month, for men capable of managing butter and cheese factories. Preference is given to home trained labor, but it is difficult to secure.

It is estimated that over $100,000 of dairy products were shipped out of the State in 1903, a very desirable feature and deserving of much encouragement. Sales came entirely from the Western States, and prices were good all along. Butter sold above twenty-three cents, and cheese above thirteen cents.

At present two milk condensaries, at a total cost of $125,000, are in progress of construction in Cache County. One is located at Logan and the other at Richmond. The former is under the management of Hon. Lorenzo Hansen; the latter under the management of C. Z. Harris. The daily capacity of the two plants is 120,000 pounds of milk, or four carloads of 30,000 pounds each of the condensed article per week. Half the yearly output of 100 cars will supply Utah and will do much to keep the price of butter and cheese within the State from fluctuating. The plants are to make butter and cheese when the conditions demand it. The price paid for milk will depend upon the fat it contains.

The number of pounds of milk received by the factories during the year was 70,000,000 pounds, the average cost of delivering milk to the creameries was 8 cents per 100 pounds; the total cost of delivering, $53,000; average test of milk, 3.91; pounds of butter made, 2,143,052; pounds of cheese made, 1,564,865; average price paid per 100 pounds of milk, 69.2; price paid per pound for butter, 17.6; price received for butter, per pound, 20.1; price received per pound for cheese, 9.4.

Number of factories in the State, 71; value of creameries, exclusive of lands, $205,452. Number of persons employed in factories, about 100; wages paid, $41,665; number of persons supplying milk, 5,200.

As a rule patrons of factories are interested therein as stockholders, so that in addition to their returns from the sale of their milk they also share in the profits of the creameries.

Canning Industry

An industry than which none has taken greater strides in recent times is that of canning fruits and vegetables. Some seventeen plants are now in operation in the State, the majority in Weber County. Since the articles canned are practically all saved—having previously been without a market, and therefore valueless prior to the introduction of the canning industry—the figures may prove of interest and should be significantly valuable. Some 400,000 cases of tomatoes, asparagus, peas and fruits, and vegetables generally, are canned annually by the seventeen factories that operate during the season. As a matter of fact their operations do not extend over 90 days. The value of these 400,000 cases is approximately $700,000. Over 2,000 persons find employment in the fields. Besides this, close on $275,000 annually is spent for wages in the canning factories, while an estimate places the area under cultivation for the production of the material canned at something like 2,500 acres.

The factories are located and produce substantially as follows: Willard Canning Factory, Willard, Box Elder County, product, 15,000 cases of tomatoes; Chief Canning Co., Plain City, Weber County, product, 12,000 cases of fruits and tomatoes; Utah Canning Co., Weber County, product, 45,000 cases of tomatoes;

Salt Lake Valley Canning Co., North Ogden, Weber County, product, 22,000 cases of tomatoes, fruits, rhubarb, catsup and jellies; Wasatch Orchard Company, Ogden, Weber County, product, 75,000 cases of peas, tomatoes, fruits and asparagus; Ogden Canning Co., Ogden, Weber County, product, 15,000 cases tomatoes; North Ogden Canning Co., North Ogden, Weber Co., product, 15,000 cases fruits and tomatoes; Riverdale Canning Co., Riverdale, Weber County, product, 15,000 cases of tomatoes; Hooper Canning Company, Hooper, Weber County, product, 15,000 cases tomatoes; Hardy Canning Co., Hooper, Weber County, product, 15,000 cases tomatoes; Syracuse Canning Co., Syracuse, Davis County, product, 15,000 cases fruits and tomatoes; Star Canning Co., Roy, Weber County, product, 40,000 cases peas, fruits and tomatoes; Uintah Canning Co., Uintah, Weber County, product, 15,000 cases tomatoes; Layton Canning Co., Layton, Davis County, product, 20,000 cases tomatoes; Kaysville Canning Co., Kaysville, Davis County, product, 23,000 cases tomatoes; Woods Cross Canning Factory, Woods Cross, Davis County, product, 40,000 cases of asparagus and tomatoes; Provo Canning Co., Provo, Utah County, product, 3,000 cases of fruits.

In addition to the above, the Wasatch Orchard Company makes some 40,000 cans daily from February 1st to December 31st, for its own use in packing tomatoes and fruits, the value of which is about $75,000. Thirty persons find employment in this plant.

Utah raises the finest celery, asparagus and tomatoes in the world.

Pickles.—Many of the above canneries also manufacture catsup, and put up pickles of the kind generally in demand. These rank well with like products manufactured elsewhere—but the extent to which they supply the domestic demand cannot yet be stated. Little if any of the pickled products are exported, though the demand for Utah canned fruits, tomatoes and asparagus is growing at a rate which not only proves the excellence of the articles but the superiority of the manner in which they are handled.

In addition to the above, a number of the factories make jellies from the various fruits raised in the State.

Combination.—A combination has been effected among those engaged in the above industries for the purpose of maintaining uniform prices. Practically all the factories are parties to the arrangement. It is known as the Utah Selling and Storage Company, and is officered by Wm. Craig, as president; Wm. Van Alan, vice president; Mr. Stringham, secretary, and J. W. Parker, treasurer.

Salt

Notwithstanding the billions of tons of salt the Great Salt Lake holds in solution, nor the mountains and mines of rock salt found elsewhere on the borders of Utah, this State markets 35,000 tons only per annum. This is charged to the unfavorable freight rates, which will not admit of the product being shipped farther east than Colorado common points. Were it not for this the annual output of salt in this State could be doubled many times over, as the product wins its way in every market where it has been introduced.

The Inland Crystal Salt Company, of Salt Lake City, has a plant for the production and refining of salt on the lake shore near the famous Saltair resort. Their method is to pump the water from the lake into open pools, where solar evaporation takes place, leaving the crystal salt to be shoveled up, milled and sacked. During 1903 30,000 tons were obtained in this way, and forty per cent. of this amount was afterwards refined while the balance was sold in its crude state. In addition to this there were some 5,000 tons of rock salt mined from the mountains in the southern part of the State.

Besides almost entirely supplying the home market, Utah salt is shipped to Oregon, Washington, Montana, Idaho, Wyoming and Colorado; and as soon as favorable freight rates can be had the supply may be increased to meet any and all demands.

While there are other plants, the company named practically controls the market open to the product of the State.

The crude salt is used in mining plants where chlorinization is necessary, and for horses, cattle and sheep, being an indispensable element for these animals, whether on the ranch or the range.

The production of salt is described in greater detail in the article on "Great Salt Lake—a Mine of Chemic Wealth."

Inland Guano Deposits

Utah, nearly a thousand miles from the ocean, has valuable guano deposits covering acres of ground and aggregating thousands of tons. Of the islands dotting Great Salt Lake there are two, Gunnison and Hat, upon which gulls and

GULLS ON HAT ISLAND, GREAT SALT LAKE

other sea birds flying inland from the Pacific coast have had their breeding grounds for ages; and to-day there are vast accumulations of genuine guano. Thus far very little has been done with these inland guano deposits, though several hundred tons of the product have been used by Utah farmers, and with most excellent results.

Mr. August H. Vogeler made a personal test of the guano found there, and in his sworn statement before the register of the United States land office, this city, appears the following: "Onions, weighing two pounds each, were grown with the aid of guano, while immediately adjoining, in the same field, onions did not exceed one-half pound each without the aid of this fertilizer. For lawns it cannot be excelled."

Mr. Chester A. Bullock, expert on fertilizers, State of Ohio, has written the Utah Guano Company as follows: "Having personally visited and made a careful

examination of the Gunnison Island Guano deposits in Great Salt Lake, Utah, I beg to state that I found them in every particular as represented to me." From numerous analyses (and some by disinterested parties) made in different parts of the United States, the average results were: Phosphoric acid, 11.61; nitrogen, 4.03; potash, .57. Mr. Bullock adds: "Being engaged in the fertilizer business for the last thirty years, I have no hesitancy in stating that you have a very valuable deposit, and your product will find a ready market."

The following analyses were made by Prof. Herman Harms.

Gunnison Island—Phosphoric acid, 8.04 (which corresponds to tric phosphate, 17.55); nitrogen, 1.16; ammonia, 1.13; nitrog. matter, 7.25; potash, .50.

Hat Island—Phosphoric acid, 19.54 (which corresponds to tric phosphate, 42.65); nitrogen, 1.28; ammonia, 1.55; nitrog. matter, 8.00, and potash, .50.

These are the only deposits of guano known to exist in this section of the country. They are within easy access. The product can be dug, sacked and placed on the train for $2 per ton.

Breweries

The breweries of the State produce 800,000 barrels of beer annually, of an average value of $8 per barrel, or $600,000 for beer. About one-fourth of this is bottled, and at least one-half of the total amount is exported, so that the income to the State from the manufacture of beer is $300,000 annually.

Utah barley is recognized as ranking among the best in the world, and certainly inferior to none produced in the United States. There is a constant demand for it at an average higher figure than the barley of most other States. It is whiter, fuller and heavier than the average barley. From this barley all the beer manufactured in Utah is made.

Utah hops, however, are not employed. Several years ago hops were raised in the State, but the industry was not encouraged by reason of the length of time it takes before satisfactory returns can be had. The consequence is that all hops employed are imported.

All the breweries in the State are equipped with every modern appliance, and are growing steadily in the face of competition with the largest breweries in the world, backed by friendly railroad freight rates. In spite of the unfavorable railroad rates Utah beer sells in competition with the product of the great brewing centers in Idaho, Oregon, Nevada, Wyoming, Colorado and Montana. There are four breweries in the State—the Salt Lake Brewing Company, the Fisher Brewing Company, Wagner Brewing Company and the Becker Brewing and Malting Company, the latter being the only one outside of Salt Lake which has been able to withstand the competition of the Salt Lake breweries as well as larger breweries outside the State. It is steadily growing and extending its operations.

Utah's Honey Crop

To tell a short, sweet story one needs only to write of Utah's honey production, and without such a story no work on this State's industries would be complete.

Utah's escutcheon is a beehive with the word "Industry," and though it was never intended that her coat of arms should signify honey-making as her chief calling, recent development in the honey business might lead those not otherwise informed to conclude that this was to be the case. As a matter of fact, it was not until recent years that the people of Utah began to open their eyes to the great possibilities of bee-culture, and though very rapid developments have followed the awakening, the industry is still in its infancy with unlimited room in which to develop and increase.

The year 1903 was an exceedingly prosperous one for Utah bee-keepers, and the future to them is more than ever promising.

The demand for Utah Honey has ever been in excess of the supply, which argues well for its quality. There is no adulteration of honey in this State, and wherever the product has gone in the past it has paved the way for larger orders to follow.

Were it possible to double the output this year, it would be found that the demand had also doubled. The annual output should be trebled within the next few years, as there is hardly a county in the State where bees would not thrive under ordinary care. The honey record of Utah for 1903 is as follows: Extracted honey, 1,500,000 pounds; comb honey, 400,000 pounds; total, 1,900,000 pounds; wax, 70,000 pounds.

In the spring of 1903 one producer had 500 colonies of bees. His harvest was 50,000 pounds of extracted honey. His average per colony of bees was 100 pounds. Many of the bee-keepers of the State averaged 200 pounds to the colony, and some of them even more. With her honey display at the Irrigation Congress held at Ogden, Utah secured the gold medal in competition with the principal honey producing sections of the whole country, and her exhibit at the St. Louis World's Fair, consisting of several tons of the product collected from all parts of the State, and including the delicately flavored pure white honey produced by bees from the constantly summer flowering alfalfa, and some of the amber shades, is bound to attract general attention and favor.

Great Salt Lake—Its Contents and Vast Chemic Wealth

IT is a matter of common knowledge that the water of the Great Salt Lake is one of the most concentrated natural brines occurring on the face of the earth. In richness of mineral contents it is barely surpassed by the Dead Sea, and is but remotely approached by any other water body of noticeable area.

Indeed, it is to this percentage of its waters that the lake owes its earliest claim to fame, a claim that antedates the time at which white men first trod the shores of this inland sea. As long ago as 1689 Baron La Hontan, a French explorer of ability and repute, heard from the aboriginal tribes of the Mississippi Valley strange stories of a great salt sea lying high amid the solitudes of the western mountains, a sea whose waters were so dense that an Indian could not sink therein.

The main points of these early stories have been fully substantiated by modern test, and hundreds of thousands of summer tourists have learned from pleasant experience the marvelous buoyancy of this lake of brine. As to density the lake water is about 1.2 as heavy as pure water, carrying over one-fourth of its weight as dissolved solids. In such a brine it is physically impossible for the human body to remain submerged, and the skillful swimmer has simply to lie at full length and float, with a wooden block for a pillow if he so desires.

In spite of this interesting fact, bathing in the deeper parts of the Great Salt Lake is not without its perils; for, if the irritating brine be drawn into the mouth or nostrils, strangulation—partial or complete—is certain. Furthermore, the unusual force of the waves must be taken into account by the swimmer who would venture into the greater depths, as even a moderate disturbance of the dense water is accompanied by a force of impact unknown to the sea bather, and the apparently insignificant shore breakers are comparable in momentum to the ocean surf.

Nevertheless the skill essential to perfect safety in the briny bath which the lake affords, is easily acquired, and for the novice the graded depth incident to the uniform and gradual slope of the lake-bed insures safety and pleasure.

The lake bottom, particularly in the vicinity of the established pleasure resorts, is an ideal bathing floor, composed as it is of the peculiar "oolitic sand" characteristic of the southern shores. This so-called sand consists of tiny spherules about the size of hemp seed, each round and smooth, and composed of calcium carbonate deposited as concentric layers about a siliceous nucleus. Such a floor is comfortably firm, yet pleasantly soft and elastic, equal indeed to a prepared bottom.

The advantages of the lake as an attractive pleasure resort and as a natural sanitarium have been appreciated and utilized from the time of the earliest settlement of the valley by the intrepid Mormon pioneers, and in the course of later years imposing pavilions have been erected at the most inviting localities. The chief of these is the Saltair Pavilion, situated at the southern end of the lake, thirteen miles due west from Salt Lake City, and reached by a twenty-minute railway ride. The pavilion proper is built on piles in the lake itself. The buildings are fashioned after the Moorish style of architecture, and were erected at a cost of a quarter of a million dollars. They cover an area of 1,115 by 335 feet, and are clustered about a tower rising 130 feet above the water surface. The popularity of the lake

as a pleasure and health resort is known the world over; and the facilities of travel afforded by two transcontinental lines bring hither multitudes of visitors every year. The lake region is reached from the east by the Union Pacific and the Rio Grande Western; and from the west and south by the Southern Pacific, and the San Pedro and Los Angeles railways.

But the lake commands public attention by other claims than those associated with inspiring scenery, and its attractions for the seeker after health or pleasure.

In the first place, guano deposits occur on some of the islands rising as mountain-tops above the present water level. This material has accumulated as a

GREAT SALT LAKE AND PAVILION AT SALTAIR

result of the undisturbed nesting of innumerable gulls and pelicans on some of the smaller islands, and the deposits are worked for the valuable fertilizers they contain.

Hat, or Egg Island is the principal rookery.

But of the lake itself, its briny waters constitute a mine of chemic riches, offering a variety of valuable products at the minimum cost of preparation. As is inevitable in the case of a standing water body, subject to evaporation and devoid of an outlet, the amount of total solids in the lake water varies greatly in accordance with the lake's wide fluctuations in volume. This sufficiently explains the great discrepancies in published accounts concerning the density and composition of the brine. The earliest recorded analysis of the water was made on a sample taken in 1850 when the lake stood at a very low level. Between that time and the present the lake has completed a cycle of increasing volume followed by a long period of recession, so that at the present writing (March, 1904) the water-body stands at a level lower than any hitherto recorded. There is to be noted a course of annual variation, whereby the volume of the lake is increased or diminished by the

seasonal relation of water supply to loss by evaporation; so that the time of the year at which the sample is taken is to be considered in connection with the analytical data. The higher water level is reached in May or June, and a low stage is characteristic of the later summer months. The following table is a compilation from authoritative reports, regarding the variable contents of dissolved solids:

	DATE OF COLLECTION	Specific Gravity	TOTAL SOLIDS		AUTHORITY
			Per cent by weight	Grams per litre of sample	
1.	1850,	1.170	22.282	260.69	L. D. Gale
2.	1869, Summer	1.111	14.9934	166.57	O. D. Allen
3.	1873, August	1.102	13.42	147.88	H. Bassett
4.	1885, December	1.1225	16.7162	187.65	J. E. Talmage
5.	1888, February	1.1261	.....	.....	J. E. Talmage
6.	1889, June	1.148	.....	.....	J. E. Talmage
7.	1889, August	1.1569	19.5576	226.263	J. E. Talmage
8.	1892, August	1.156	20.51	238.12	E. Waller
9.	1892, September	1.1679	21.47	250.75	J. E. Talmage
10.	1893,	.....	20.05	.....	J. T. Kingsbury
11.	1894, December	1.1538	21.16	244 144	J. E. Talmage
12.	1895, May	1.1583	21.39	247.760	J. E. Talmage
13.	1900, June	1.1576	20.90	241 98	H. N. McCoy & Thos. Hadley
14.	1900, July	1.1711	22.89	268.09	H. W. Sheley
15.	1900, August	1.1805	23.36	275 765	H. W. Sheley
16.	1900, October	1.1860	24.03	285.020	H. W. Sheley
17.	1901, September	1.1979	25.221	302.122	L. J. Seckels
18.	1903, October	.....	.....	.....	J. E. Talmage

The dissolved solids consist principally of sodium and magnesium salts, the chlorides predominating. Potassium compounds are also present, while boric and phosphoric acids are found in traces, and lithium occurs in quantity readily detected by spectroscopic tests. Bromine exists in the water in small amount—about 1.4 parts per millim as the maximum quantity yet determined. Iodine has not been found in the brine.

The following data show the amounts of the components in the dissolved solids:

Composition of dissolved solids occurring in Salt Lake water, acids and bases theoretically combined, expressed in percentage of weight of samples:

	Gale 1850	Allen 1869	Bassett 1873	Talmage 1885	Talmage 1889
Sodium Chloride	20.20	11 86	8.85	13.586	15.743
Sodium Sulphate	1.83	0.93	1.09	1.421	1.050
Magnesium Chloride	0.25	1.49	1.19	1.129	2.001
Calcium Sulphate	....	0.09	0.20	0.148	0.279
Potassium Sulphate	....	0.53	....	0.432	0.474
Potassium Chloride	....	....	1.89	.....	.....
Total	22.28	14.99	13.42	16.716	19.557

Common salt was the first and is still the chief of the useful products derived from the lake brine. Yet, strange as it may seem, less than a quarter of a century ago salt was regularly imported into Utah—an enterprise more surprising than the proverbial carrying of coal to Newcastle. Explanation is found in the

fact that the early methods of preparing salt from the lake were primitive and inefficient, so that Utah salt acquired an unenviable reputation.

The earliest attempts at salt manufacture here consisted in impounding shallow portions of the lake by dykes, and in allowing the imprisoned brine to evaporate under the sun's heat. Plainly the product of such treatment was not salt alone, but a mixture containing all the solids of the brine, sodium sulphate so plentifully present, and gave to this impure residue a marked efflorescent character, so that the salt was unfit for dairy use as it refused to remain incorporated with the butter; while the magnesium compounds imparted a bitter taste, thus rendering it unfit for the table.

At the present time salt works of considerable importance are maintained on the lake shores, and the manufactured product from the best of these ranks among

ANTELOPE ISLAND, GREAT SALT LAKE

the purest varieties of commercial salt. The method now followed at the works of one of the principal companies—the largest producer in the field—is as follows:

The lake brine is lifted by centrifugal pumps to a height of fourteen feet above lake level; it is then conveyed by flumes to the settling and evaporating ponds, which are situated from one to two miles inland. These ponds cover about fourteen hundred acres of land. The pumps pour into the flumes approximately fourteen thousand gallons of brine per minute, and are kept in operation about ten hours daily during the pumping season, which embraces a period of about 150 days, beginning usually in March. By the time the ponds have been filled the evaporating season is well advanced, and about the same supply of water is required during the warmer months to maintain the level.

A part of the pond area is used as settling basins, wherein the water deposits its suspended matters; thence it is conveyed to the evaporating ponds proper. The desiccation is accomplished by solar heat alone. When the salt has been deposited the mother-liquor, containing the objectionable compounds, is returned to the lake. An average deposit for the season is a salt layer about six inches deep. This affords a yield of about 900 tons per acre, giving a rate of about 150 tons per inch depth per acre. The salt harvest begins in late August or early September.

With the entire pond area owned by this company alone, a yearly crop of over a million tons may be secured at the cost of pumping and harvesting; and the

ponds of other companies could bring the possible yield under existing facilities to fully one and three-quarter millions of tons. For such a supply there is no market; and the maximum harvest yet of record is below a quarter of a million tons. The coarse salt can be sold when loaded on the cars at the works at a dollar per ton.

For table use the salt is refined at the works. The process consists in crushing, drying and winnowing while hot. The crude salt, after crushing, is run through a revolving drying cylinder, heated by steam. The dried salt falls into a compartment through which a blast of air is driven; this removes very completely the sodium sulphate and other efflorescent ingredients. The granular product from this stage is ground to the proper degree of fineness as required for packing, dairy and table use. The salt so prepared is of exceptional purity, as the following data will show:

Analyses by Dr. J. E. Talmage, F. R. S. E., etc., of Salt Lake salt, samples purchased in the retail market:

	COMPANY A		COMPANY B	
	Refined Salt Per Cent.	Table Salt Per Cent.	Coarse Salt Per Cent.	Table Salt Per Cent
Sodium Chloride	98.407	98.121	98.101	98.300
Calcium Chloride	.371	.311	.322	.345
Calcium Sulphate	.650	.422	.364	.680
Magnesium Sulphate	.030	.022	.021	.042
Moisture	.442	.911	.952	.158
Insoluble Matters	.102	.201	.214	.472
Loss and Error	....	.012	.026	.003
	1000.02	100.000	100.000	100.000

Next to common salt, sodium sulphate claims attention as a profitable product of the lake brine. This substance is insoluble in a strong brine at low temperature, and every winter it separates spontaneously from the water as soon as a certain critical point of temperature—near 32 degrees F. or 0 degree C.—is reached. This material is known commercially as glauber salt, and mineralogically as mirabilite. As it crystallizes from the brine at winter temperature, the lake is rendered opalescent, and the sulphate settles on the lake bed, or near shore and is cast up by the waves in windrow-like mass, as sea-weed is thrown up on the ocean brink. As the temperature of the water rises, the glauber salt is taken again into solution, so that to be secured it must be removed beyond the lap of the waves; this is easily accomplished by the use of horse-drags. The abundance of deposit each year is surprising. Indeed, during the cold months a visitor to the lake shore has to wade through the glauber salt accumulation, sinking at each step to the knees. That the material so lavishly supplied approaches a state of typical purity is shown by the following results of analyses. For comparison it should be noted that chemically pure mirabilite, sodium sulphate, or glauber salt, consists of: Sodium sulphate, 44.1 per cent; water, 55.9 per cent.

Sodium carbonate, so important in the industrial arts that without it civilization would not be what it is, is generally manufactured from common salt by the time-honored and efficient Le Blanc process, the first stage of which consists in converting the sodium chloride, or common salt, into sodium sulphate, or glauber salt, by treatment with sulphuric acid. This stage of the sodium carbonate preparation is here accomplished by nature, on a scale unapproachable by man; and the sulphate is heaped up on the shore, his for the taking.

Analyses of mirabilite or glauber salt, collected from winter deposits on the shores of the Great Salt Lake, by D. J. E. Talmage, F. R. S. E., etc.

	East Shore Deposit Per Cent.	West Shore Deposit Per Cent.
Sodium Sulphate	43.060	42.325
Water	55.070	55.760
Sodium Chloride (salt)	.699	.631
Calcium Sulphate	.437	.267
Magnesium Sulphate	.025	.018
Insoluble Matters	.700	.756
Loss and Error	.009	.243
	100.000	100.000

And should the supply thus thrown up by the waves be insufficient for the demand, the lake bed can be successfully dredged during the winter months, for thereon falls the greater part of the sulphate deposit. Furthermore, in an earlier stage of the lake history, sodium sulphate was deposited on the margin, and over areas now inshore in enormous quantities. In the driving of piles for Saltair pavilion and other lake resorts, a bed of so-called "soda," really sodium sulphate or glauber salt, was encountered, in thickness ranging from three to eight feet; and inshore excavations have proved that this bed extends far inland from the present lake brink.

A factory for the preparation of sodium compounds, such as carbonate, bicarbonate, hydroxide, hypo-sulphite, etc., was successfully operated years ago, but the enterprise was killed by the prohibitive cost of railway transportation of the product. The disadvantage is the incubus through which so many enterprises of the resourceful West have been crippled or killed.

But the passing years bring changed conditions, and even to-day the special gift of the prophet is not required to predict that ere long the riches of the West will command and control the accumulated capital of the East. In this grand consummation Utah will maintain a prominent part, and the chemic riches of the Dead Sea of America will materially enhance the volume of the nation's wealth.

[For a fuller account of Utah's Dead Sea, its scenic beauties, geological history, marvelous properties, its living inhabitants, and economic importance, as also of its predecessor, Lake Bonneville, an inland sea as large as Lake Huron, and the Great Basin in general, see "The Great Salt Lake, Present and Past," by James E. Talmage, Ph. D., F. G. S., F. R. S. E., Professor of Geology, University of Utah.—The Deseret News, Salt Lake City, Utah. (25 cents.)]

A World of Hydrocarbon Wealth in Utah

HYDROCARBONS.—The chemist applies the term "hydrocarbon" to any compound composed entirely of the elements hydrogen and carbon, whether of natural occurrence or a laboratory preparation. The mineralogist extends the application of the term to include all naturally-occurring minerals consisting essentially of hydrogen and carbon, though possibly containing oxygen, and, in smaller quantity, other accessory elements. It is with the latter application of the term we have to deal in considering the hydrocarbon minerals of our State.

A detailed classification of hydrocarbon minerals would include:

1. Bituminous hydrocarbons. These may be subdivided as follows:
   - (1) Gaseous, such as marsh gas, and natural gas.
   - (2) Fluid, including naphtha and petroleum.
   - (3) Viscous, comprising maltha, mineral tar, mineral pitch, etc.
   - (4) Elastic, comprising elaterite and wurtzilite.
   - (5) Solid, such as grahamite, uintaite and the coals.
2. Resinous hydrocarbons, including succinate (amber), copalite, etc.
3. Cereous hydrocarbons, to which division belong ozocerite and its allies.
4. Crystalline hydrocarbons, comprising certain rare minerals of little importance aside from their mineralogical interest.

To these must be added certain modified occurrences, such as (1) bituminous or asphaltic limestone, (2) asphaltic sand, (3) asphaltic earth, and (4) bituminous schists.

All of these minerals and rock-mixtures have been made of valuable application to the needs of man; and their occurrence in quantity is of commanding interest. Utah is particularly rich in hydrocarbon deposits, and the occurrences within the State comprise most of the varieties tabulated above.

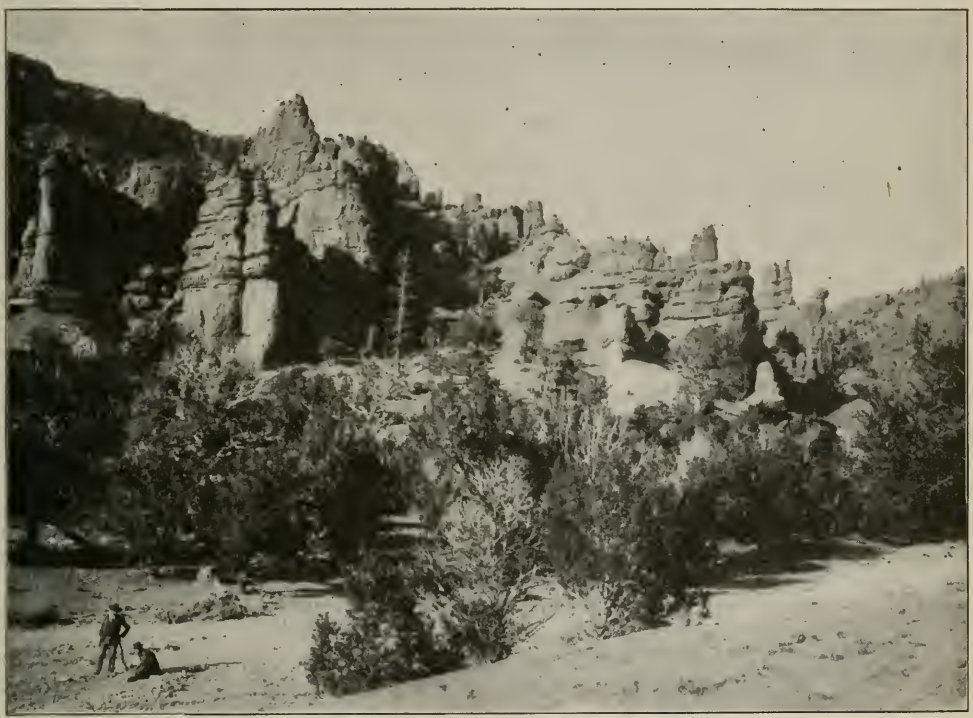
The principal deposits of these minerals in Utah are found in the Uintah Basin, an area depressed as compared with the surrounding mountains and plateaus, yet with a floor elevated from 5,000 to 6,000 feet above sea level. The northern rim consists of the Uintah Mountains and the succeeding plateaus. The Uintahs constitute an exceptional range, comprising a single main anticlinal fold, and, unlike the majority of the Rocky Mountain ranges, trending east and west. In the south the Uintah Basin is bounded by the Roan or Book Plateau, which terminates in an escarpment of magnificent proportions, generally known as the Book Cliffs.

Within the Uintah Basin the principal exposures, geologically speaking, are of comparatively recent age—belonging mostly to the eocene-tertiary formations; though, within the limited areas of greater depth, as laid bare by erosion, there occur well defined deposits of plustocene, eocene, cretaceous, jura-trias, carboniferous, and even archean rocks.

The basin is naturally divided into an eastern and western section by Green River, which stream traverses the greater part of the region through canyons of impressive dimensions cut to a depth of from 1,000 to 3,000 feet below the general level.

In the western half of this basin are found the abundant deposits of hydrocarbon minerals for which Utah is already famous. The principal occurrences known to exist in quantity consist of uintaite (gilsonite), wurtzilite, elaterite, ozocerite, maltha, and a great range of bituminous or asphaltic limestone, sandstones and shales.

Uintaite was named by Professor W. P. Blake in 1885. The name was given to a variety of asphalt from the Uintah Basin, now known as gilsonite. The name "uintaite" antedates "gilsonite," and is the mineralogical designation of this min-



CLIFFS—"THE BATTLEMENTS"—NEAR PANQUITCH

eral; nevertheless "gilsonite" is the name common in trade and commerce, and will probably persist. It was bestowed in honor of Mr. S. H. Gilson, a Utah citizen.

Uintaite or gilsonite has been found in quantity sufficient to warrant extensive mining operations on the Uncompahgre Indian reservation, and on adjacent lands. It is the one hydrocarbon of western occurrence that can be shipped to eastern centers of consumption, even under the high railway tariff at present in force.

In the southern part of the Uintah Reservation, and on adjoining lands beyond its border, elaterite, and the closely related form wurtzilite, known in the trade as mineral caoutchouc, occurs in considerable quantity. Along the divide between the drainage basin of Green River and that leading to the Great Salt Lake, particularly at or near Soldier Summit on the Rio Grande Western Railway line, ozocerite, or mineral wax is mined. This mineral here occurring excels in quality, as in the extent of its deposit, the famous deposits in Galicia and the region of the Caricasus.

Maltha, a viscous or tarry variety of bituminous hydrocarbon, is found naturally welling forth upon the surface, or reached by shallow and inexpensive workings, at many places between Spanish Fork and Soldier Summit, as also northeast of Castle Gate in Emma Park.

Asphaltic limestones are mined between Soldier Creek and Strawberry Valley, and their outcrop is particularly marked in the vicinity of Tucker (Clear Creek Station on the Rio Grande Western Railway).

Asphaltic sandstones are common in the valleys within the western half of the Uintah Basin. In the Ashley Valley they are extensively worked as a source of cheap and excellent paving material. The town of Vernal, Uinta County, small and isolated as it is, boasts of paved streets and asphalt boulevards such as would be a credit to metropolitan cities. The material is broken into lumps of small size, laid down upon the roadway and reduced to a level surface by hot rollers.

Of the hydrocarbons occurring in the Uintah Basin, and in Utah as a whole, by all means the most important under present conditions is uintaite, heretofore specified as the gilsonite of commerce and trade. This mineral is a black substance, of brilliant luster and conchoidal fracture, suggestive of solidified pitch. On exposure it loses its brilliant luster and becomes dead black, but the change ordinarily extends to an insignificant depth only.

In the vein the mineral is of columnar structure, the long axes of the columns being at right angles to the inclosing walls, thus indicating a heated injuncture subsequently cooled.

Uintaite (gilsonite) occurs as true veins, that is, as fillings of fissures which cut through the sedimentary formation of the region. In one sense these veins should be regarded as dykes, inasmuch as the filling has resulted from injection of material in a molten or plastic state, and not by slow deposition from solutions. It is not within the scope of the present article to discuss the probable mode of deposit, or to deal with the theories of origin of these occurrences, however interesting and attractive such a topic may be. The fact is that we find within the Uintah Basin true veins or fillings of pre-existing fissures, the contents of which are hydrocarbons of value and use. Of these deposits uintaite (gilsonite) is in such demand that it can be mined, sacked and shipped at a profit, in the face of strenuous competition in Eastern markets.

Chemical analysis shows typical uintaite to consist of:

Volatile matter	56.46%
Fixed residue	43 43
Ash	10
	99.99

Ultimate analysis reveals as the components:

Carbon	98.30
Hydrogen	9.96
Sulphur	1.32
Ash	.10
Oxygen and Nitrogen (undetermined)	.32
	100.00

While uintaite (gilsonite) as it occurs in nature is brittle, by proper treatment it becomes sufficiently coherent to serve as the chief ingredient in prepared varnishes and japans. For these purposes it is heated with linseed oil and thinned with turpentine. The uses of the material, as enumerated in the United States Government reports, are as follows:

For coating ship bottoms to prevent electrolytic action; for coating barb wire fences, etc.; for coating sea-walls of brick or masonry; for covering paving brick;

for acid-proof lining of chemical tanks; for roofing pitch; for insulating electric wires; for smokestack paint; for lubricants of machinery; for preserving iron pipes from corrosion and acids; for coating poles, posts and ties; for teredo-proof pile coating; for covering wood-block paving; for the manufacture of Cotton garden hose, as a substitute for rubber; for the manufacture of brickette and compressed coal slack, as a binder pitch.

It is generally known that the principal supplies of hydrocarbon minerals for use in the United States are derived from Trinidad. Water transportation is so much cheaper than shipment by rail that the foreign product has been imported at a lower cost than that required for the delivery of the Utah minerals at the centers of consumption. This is the sole and sufficient explanation of the comparatively small demand for the Western hydrocarbons. Gilsonite (uintaite), however, is of a quality to command recognition even in the face of cheap importation of the inferior materials. The principal occurrences of this mineral in the Uintah Basin are as follows:

The Duchesne vein, located within three miles of Fort Duchesne. This is a nearly vertical vein, traceable by surface outcrop for about three miles on its strike, with an average width of one and one-half feet, reaching in places a breadth of from three to four feet.

The Culmer vein, averaging fourteen inches in thickness, has been prospected for a distance of over two miles on its strike.

The Seaboldt vein, parallel with the Culmer, and averages a foot in width. To these must be added:

The Bonanza and Cowboy group of claims, which are to be counted among the most important and promising of all the deposits of uintaite in the region under description. The outcrops may be traced for miles, and the product is of the highest quality. The Bonanza vein attains a maximum width of ten feet, and on the Cowboy a breadth of eighteen feet has been observed. From this point of greatest width it maintains a breadth of ten to twelve feet for a distance of about three miles.

The Black Dragon vein shows a width of from eight to nine feet. This is located near Upper Evacuative Creek. The enclosing walls, which are practically vertical, are impregnated with the hydrocarbon deposits to a distance of from a foot to three feet from the vein proper.

Beside the veins specifically named, there are many others, approximately parallel in course and dip, but at present exploited only to slight extent.

Of the allied hydrocarbons, wurtzilite, elaterite, ozocerite and maltha, as well as an extended series of bituminous (asphaltic) sandstones, limestones and shales, it is to be said that in spite of their abundance and accessible occurrence, they are at present used for local application only, owing to the prohibitive tariff of railway transportation.

Gilsonite (uintaite) and its hydrocarbon allies occur elsewhere in Utah. The former is profitably mined in Wasatch County, and bituminous limestone is produced in paying quantities in Utah County. The production of uintaite alone averages in amount from one to two thousand tons per year. It is profitably shipped to the railway by the otherwise light-going freight teams plying between Vernal and Price.

Demonstrated facts warrant the statement that the hydrocarbon deposits of Utah surpass in variety, purity and extent all other recorded occurrences. They outcrop in a manner conducive to cheap mining, and transportation facilities alone are lacking to make the deposits a bonanza of wealth to the owners and a cheap source of valuable and most desirable material to the consumer.

These deposits are known to extend far beyond the limits of the Uintah Basin.

As far south as St. George, Washington County, and at numerous intermediate points asphaltum of many varieties has been found; and during recent months deposits of maltha and heavy petroleum have been discovered within the Salt Lake basin, in fact on the very margin of this briny sea.

Exploitation in search of petroleum, stimulated by many oil "signs," is being prosecuted both in the Uintah Basin and elsewhere in the State. Many natural occurrences of heavy oils are known and located; and the extensive deposits of

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bituminous and oil-bearing shales in Juab and Grand Counties are controlled by companies organized to distil the oil from the asphaltic and paraffine-bearing rocks.

At present extensive prospecting and experimental tests are in progress to demonstrate the presence or absence of oil in the bituminous deposits of Utah. Such operations are in progress in Grand, Juab and Uintah Counties, as also in the region immediately bordering the Great Salt Lake.

However, the question of Utah's claim to distinction as a region of oil occurrences is to be treated in a special article. The same may be said of coal, which substance while an undoubted hydrocarbon according to the classification adopted by the chemist and mineralogist, is not so classed in the popular mind. The coals of Utah are of later date than the anthracitic and bituminous deposits of the East, yet they compare favorably in composition and calorific qualities with the best deposits of their kind.

Utah is particularly rich in hydrocarbon deposits of practically all important kinds. The lack of a market that can be reached at a moderate cost for transportation is the sole requisite to the pre-eminence of the State as a producer of hydrocarbon minerals of many kinds.

For further information see Eldredge's Reports in the 17th and 22nd Annual Reports, U. S. G. S., on hydrocarbons in general, and particularly on Utah occurrences.

Oils

If opinions of geological experts go for anything, a great petroleum field will one day be developed in Utah. The presence of the fluid in the State is demonstrated in many sections by oil springs and outseeps, some of which, by a little development have been made to produce from a half barrel to two barrels of crude oil per day. The quality of this oil is graded from the lower grade asphalt crude to the highest grade of the mineral in the form of paraffine base petroleums. These seeps appear from Cache County on the north to San Juan County on the south. But until recently very little work in the line of development in the neighborhood of any of them has been attempted. It is not alone to the seeps and springs that the experts have been attracted. Where the formations have been broken by upheavals, or cut by erosions, great strata of oil sand have been exposed, which yet contain such quantities of petroleum as to prove beyond question that at one time at least they have contained enormous quantities of the fluid. Great shale beds have also been found so rich in mineral oil that they rival the famous shales of Scotland, from which such enormous quantities of oil have been extracted.

The first section of the State to attract the attention of the oil men lies in the eastern central portion, covering three counties (Carbon, Grand and Emery), and lapping over into Utah County, the one just below Salt Lake County. Three great anticlinal folds pass through this country. On the apex of each can be traced for miles the oil sands mentioned above, and along which oil springs and oil seeps occur with great frequency. So great are these in number that over three hundred have been located. The late P. Y. Knight, State geologist of Wyoming, and a noted oil expert, divides the central Utah field into three great basins. The central basin has its lowest portion in the Green River Valley in the midst of the noted Book Cliffs. Another has for its eastern and southern rim the Henry Mountains, while the third finds its center in the Uintah Indian Reservation.

In none of these has any development work at depth been done. Several wells have been started and are now in the process of drilling. Few of these have got below the first carboniferous geological age, and not one of them has attained a depth great enough to encounter the oil sands.

An oil field detached from all the others has been partially opened up in the canyon of the San Juan River, in the county of the same name. This San Juan River is a tributary of the Colorado and in eating its way through the formations it has exposed several very rich oil sands. The lower sand is just below the level of the river and several shallow wells have been sunk tapping the sand. Some of these wells are merely shafts sunk for a depth of less than twenty-five feet, and are producing a considerable quantity of very high grade paraffine base petroleum. The difficulty of the development of this field lies in the fact that it is so far away from means of transportation, and the country surrounding it is in character so rough as to render it nearly inaccessible.

The field now attracting the greatest attention lies in the valley of the Great Salt Lake, and extends from Salt Lake City north to Promontory, nearly seventy-five miles, and then follows the shore line south along the west side of the Lake.

Conditions here are very similar to those obtaining in the Baku oil fields, and along the Caspian Sea, Russia. In the lake south of the Promontory several oil springs have been vomiting asphaltum oil into water for ages. So great has this discharge been that several asphaltum islands have been formed. Springs which produce petroleum also exist in Salt Lake City itself, and the shore line of the lake has been rendered uneven by countless gas mounds, while gas issues from almost every water well sunk in the district. On Antelope Island, in the lake, a fissure in the rocks exposes a great amount of asphaltum which has been forced up from below.

The valley of the Great Salt Lake is the geological as well as the geographical basin of northern Utah. The Great Salt Lake itself is the wraith of the once mighty Lake Bonneville, whose shore line can be traced through the mountains for hundreds of miles. Dr. Jas. E. Talmage, geologist of the State University, who has made a close study of this lake bottom, says that the former waters of the great Lake Bonneville disappeared almost entirely by evaporation, and that during this process a great many morasses were formed where marine vegetation was very rank. Animal life in the form of fish and reptile was likewise abundant. At the time of the upheaval which formed the basin by throwing up the Wasatch range of mountains and the Sierra Nevada mountains, which forms the rims of the Great Basin, the depression was very great. This depression has gradually been filled by the erosion of the mountains until the made land in certain sections is estimated to be 2,000 feet deep. By this means the vegetable and animal matter has been covered up, and after decomposition has been recomposed under the influence of salt water, which is in accordance with a popular theory of the formation of the hydrocarbons.

Prof. Cowel, of the land department of the Standard Oil Company, who visited the valley shortly after a trip made by him to the Russian oil fields, stated that the conditions here were so like those at Baku that he felt certain that this region would some day be developed into a great oil field.

The oil in the Salt Lake Valley cannot be a paraffine base, as everything points to it being of a character similar to that found in California, possibly containing a greater amount of the distillants, but yet an asphalt oil.

Several important Eastern oil operators are already in this field sinking for oil, and many other operators are securing holdings with the avowed intention of driving wells. That the valley will be prolific in gas has already been demonstrated; that the opinions of experts will be realized by anticipated discoveries remains at the present time to be proven.

Another field, and one which is as yet untouched, is in the most northernly county of the State (Cache County). The presence of natural gas in this field is beyond question. Explosions of gas occur there frequently, and a well driven in the neighborhood threw out enormous quantities of rock. Conditions there are somewhat the same as those in the Salt Lake Valley, since Cache Valley was beyond question at one time the bed of a mountain lake. Gas "blow outs" of fearful dimensions are present in the section, but these have attracted the attention of oil men only within the past year.

To sum up the oil situation in Utah, it may be said that the surface indications seem to show several great oil fields, but development work has scarcely started, so that the presence of petroleum in the State in paying quantities is yet to be demonstrated by the drill.

Oil Shales

From the vast beds of shale or hydrocarbon rock found in many parts of Utah, there promise soon to be developed divers and extensive commercial enter-

prises. These beds are found in Utah County, from whence they extend eastward, often in broken bodies, to the Colorado line, cutting the Uintah Reservation in their course. They also appear in Sanpete, Juab and San Juan Counties, and in other localities to a greater or less extent. The tonnage of these shales is beyond computation and the supply is practically inexhaustible. They are sedimentary deposits, lying in blanket form with a dip generally of about twenty degrees from a horizontal position. These bedded veins vary in thickness from five to sixty feet, and often several strata cover the same territory, one above another. From surface outcroppings along the strike of the veins and where they are cut by canyons, an unbroken body of the shale can be frequently traced for miles.

When it is considered that these rocks hold approximately 48 per cent. oil, it can be readily understood that in them is contained, although now in an unprofitable form, the largest quantity of petroleum yet discovered in mother earth. These oils, though in a refractory form and held persistently by the rock, are of excellent quality and include every grade of petroleum, from petroleum ether to the heaviest of mineral waxes. Containing approximately three barrels of oil, of 40 gallons each, to the ton, the rock is capable of producing more heat than a like weight of coal. It burns readily. When the hydrocarbons are burned, the residue does not disintegrate like ordinary ashes, but remains the same shape as before burning, so that the shales cannot be used in the ordinary form of grates for fuel. Another disadvantage, which is equivalent to a loss, found in attempting to burn the rock for heat producing purposes, is the unusual amount of heavy smoke produced, the result of imperfect combustion, caused by the mixture of so many grades of oil, the light oils in burning taking off the heavy oils in smoke.

The containing rock and the oils form a complete mechanical mixture to the minutest particles. To separate them so as to secure a liquid, many attempts, with heretofore discouraging results, have been made at a cost of much time, money and unrewarded anxiety.

To secure this separation by pressure is evidently impossible, for the stuff has already been subjected to greater pressure by nature than human ingenuity can devise; to effect it by leaching would require an agent sufficiently powerful to reduce to a slime over a half ton of rock for every three barrels of oil produced, and a solvent for the hydrocarbons beside. Neither of these agents has yet been found. The only method remaining is distillation, and by this method Mr. S. L. Hague claims to have solved the problem of releasing and saving these oils. His process, as he puts it, is not complex, but in its operation it must be exact and conform strictly to the conditions that exist.

These hydrocarbons, when subjected to heat, begin to volatilize below boiling heat and are not all changed to vapor until a temperature approaching 1,300 degrees Fahrenheit is reached, so that to expel the oils from the shale, temperatures are required that cover a range of about 1,100 degrees. When it is remembered that, if vapors are subjected to heat much in excess of that required to form them, permanent gases that will not condense are made, part of the difficulties encountered in making oil from shale become apparent. It may also be stated that oils volatilizing at high temperatures will condense at correspondingly high temperatures; that is, a temperature at which vapor formed from a heavy oil will condense, is a much higher degree than is required to form vapor from a lighter oil.

In order to convert these hydrocarbons to vapors it is essential that the shale be pulverized; otherwise, if treated in lumps, when a heat is obtained sufficient to volatilize the heavy oils at the surface, its intensity will be such as to convert the vapors from the lighter oils within into permanent gases. When permanent gases are produced the making of oils practically ceases, as the gases, being lighter,

ascend to the top of the retort and, being expansive like steam, press the vapors down and prevent them from escaping.

In order then to obtain oil, the pulverized shale is passed through a retort by means of a conveyor and the retort is subjected to the simultaneous application of a series of temperatures along its outer surface, the shale passing from the cooler toward the hotter end of the retort. The degrees of heat conform substantially to the requirements of every grade of oil found in the material being treated. The interior of the retort above the pulverized shale is divided into compartments by partitions over and partially around the conveyor. From the different compartments the vapors are forced into separate condensers, the object being to avoid making gases by increased heat, to avoid condensation within the retort, and to secure, in a measure, fractional distillation.

When the rapidly increasing uses of petroleum are considered, the future importance and value of these shales will prove evident.

The residue from these rocks, after the hydrocarbons have been expelled, will, in some and probably in many instances, be of value, so that in their treatment there will be practically no waste.

A body of the shale at Tucker, Utah, when burned, produces a perfect natural cement. Other deposits on being tested may and probably will produce material for brick, tiling, pottery and other earthen products.

In burning the rocks without resorting to distillation, as can be done in making cement, where no other fuel than the hydrocarbons as they appear in the rock is needed, a superior lamp-black can be saved from the cost in the manufacture of cement.

The generally accepted theory for the presence of the hydrocarbons in the shale, and it is a reasonable one since it conforms to the conditions that exist, is that the hydrocarbons were forced by heat from greater depth through fissure veins, either in liquid or vapor form, and absorbed by the rock. In the fissure veins beneath the shales are found mineral waxes, including gilsonite, grahamite, elaterite, albertite, and many other varieties, some of which are as yet unclassified. These waxes are the residue of oil and are yearly coming into more general use. The presence of the waxes under these circumstances is identical with the conditions sometimes found in an oil well, when torpedoes are used to expel the accumulated residue.

Coal Resources of Utah

[By Robert Forrester.]

History.—The early history of coal in Utah is closely associated with the first settlement of the State. In 1851 George Wood discovered coal near Cedar City, Iron County; in 1853 Captain Gunnison mentions coal in what is now Emery County; in 1855 Brigham Young, the governor of the State, tells of the discovery of coal in San Pete County. Immediately after the last discovery, steps were taken to mine this coal and place the same upon the market, as is shown by the following copy of the first advertisement of coal within the State of Utah. This advertisement appeared in The Deseret News of June 6th, 1855:

MOUTH OF CLEAR CREEK MINE
14 Foot Vein of Coal

"As some of the brethern in San Pete are mining in the newly discovered coal bed, and will soon be hauling coal into this city (Salt Lake City) for sale, all who wish to purchase are requested, at the earliest opportunity, to leave their names at Governor Young's office, with the quantity they wish to buy, the kind of pay they intend to offer, and the time they require in which to make payments. The price will be determined as soon as the colliers and wagoners can learn the cost of mining and hauling, and then it can be decided whether coal or wood can be afforded at the cheapest rates; but in either event it will be politic to encourage the trade, for though wood may be more readily procured by some, still there are blacksmiths and many others who will doubtless prove coal to be the most economical fuel for their use, and it is anticipated that in a short time it will be much the cheapest."

In 1864 coal was discovered in Summit County, at Coalville, and by 1867 coal had been found pretty generally distributed throughout the present known coal areas of the State, as the reader will note from the following, published in 1867:

"The eastern part of the Territory (now State of Utah) contains large seams of coal. As it has been found as far south as Pahranagat and at San Pete, it is not improbable that it abounds in many parts of the Green River valley. The coal from Pahranagat is found about three hundred miles southwest from Salt Lake

City; that from San Pete about one hundred and twenty miles. These discoveries tend to justify the conclusion that coal exists in large quantities in the Territory."

From this time on mines opened throughout the State, until at the present time one hundred and thirty-eight mines are reported by the State mine inspector, the great majority of which, however, are only supplying the local demand in the vicinity of the openings.

Production.—Prior to 1876 no statistics of the amount of coal produced has been made up. From that year to the present time the amount is shown in the subjoined table:

PRODUCTION OF COAL IN UTAH

YEAR	AMOUNT	YEAR	AMOUNT	YEAR	AMOUNT
1876	50,400	*Br't Fwd.*	1,806,120	*Br't Fwd.*	4,577,546
1877	50,400	1886	200,000	1895	471,856
1878	67,200	1887	180,021	1896	418,627
1879	225,000	1888	259,501	1897	521,560
1886	225,000	1889	236,651	1898	593,709
1881	225,000	1890	318,159	1899	786,049
1882	250,000	1891	371,045	1900	1,224,156
1883	250,000	1892	361,314	1901	1,382,470
1884	250,000	1893	413,205	1902	1,638,829
1885	213,120	1894	431,530	1903	1,762,178
Car. Fwd.	1,806,120	*Car. Fwd.*	4,577,546	TOTAL,	13,376,980

For the last four years the output by counties is as follows:

COUNTY	1900	1901	1902	1903
Carbon	1,085,374	1,263,886	1,526,387	1,596,027
Summit	75,252	55,249	49,841	66,411
Grand	530	.....	.....	.....
San Pete	3,500	2,585	7,901	10,450
Iron	250	.....	.....	1,000
Emery	5,500	1,500	1,700	13,290
Uintah	6,500	7,750	.....	10,000
Other Small Mines	47,250	51,500	53,000	64,700
TOTALS	1,224,156	1,382,470	1,638,829	1,762,178

DISTRIBUTION OF COAL PRODUCED IN UTAH

YEAR	Loaded at Mines for Shipment	Sold to Local Trade and Employes	Used at Mine for Steam and Heat	Made Into Coke	Total Production	Total Value	Average Price per Ton
1991	315,711	8,233	21,650	25,451	371,045	$ 666,646	$1.80
1892	321,431	6,775	6,509	26,298	361,013	562,625	1.56
1893	350,423	7,649	4,258	50,875	413,205	611,091	1.48
1894	364,675	11,173	6,892	48,810	431,550	603,479	1.40
1895	376,479	25,097	7,253	63,027	471,836	617,349	1.31
1896	340,338	9,171	7,411	61,707	418,627	500,547	1.20
1897	324,770	22,667	9,198	64,925	521,560	618,230	1.19
1898	385,716	11,542	9,845	86,606	593,709	752,252	1.27
1899	753,881	13,303	13,046	5,819	786,049	997,271	1.27
1900	1,082,723	17,355	18,650	28,299	1,147,027	1,447,027	1.26
1901	1,272,848	18,333	30,446	987	1,322,614	1,666,082	1.26
1902	.....	.....	.....	.....	.....	.....	....

COAL PRODUCT OF UTAH IN 1899 BY COUNTIES

COUNTY	Loaded at Mines for Shipment	Sold to Local Trade and Employes	Used at Mine for Steam and Heat	Made Into Coke	Total Production	Total Value	Average Price per Ton
Carbon.....	719,544	4,972	10,000	5,819	740,335	$926,523	$1.25
Iron.....	.....	629	.....	.....	629	1,442	2.29
Summit.....	31,262	1,554	3,046	.....	35,862	50,748	1.41
Uinta.....	.....	5,478	.....	.....	5,478	12,214	2.23
Emery and San Pete.....	3,075	670	.....	.....	3,745	6,744	1.69
TOTAL.....	753,881	13,303	13,046	5,819	786,049	$997,671	$1.27

The production for this year (1899) is thirty-two per cent. over that for 1898. The value increased proportionately, however, there was no advance in price.

Of the coal produced in Utah, Carbon County has, in 1898 and 1899, produced nearly ninety-five per cent.

COAL PRODUCT OF UTAH IN 1900 BY COUNTIES

COUNTY	Loaded at Mines for Shipment	Sold to Local Trade and Employes	Used at Mine for Steam and Heat	Made Into Coke	Total Production	Total Value	Average Price per Ton
Carbon.....	1,036,951	7,145	14,965	28,299	1,087,360	$1,360,835	$1.25
Iron.....	.....	661	10	.....	671	1,527	2.28
Summit.....	42,222	4,818	3,650	.....	50,690	70,404	1.39
Uinta..... ...	.....	3,816	25	.....	3,841	6,504	1.69
Emery and San Pete.....	3,550	915	.....	.....	4,465	8,480	1.90
TOTAL	1,082,723	17,355	18,650	28,299	1,147,027	$1,447,750	$1.26

The output for the State has this year reached 1,000,000 tons for the first time in its history—an increase of about forty-six per cent. Carbon County still stands at the head of coal mining counties, with a credit of ninety-five per cent. of the total production of the State.

COAL PRODUCTION OF UTAH IN 1901 BY COUNTIES

COUNTY	Loaded at Mines for Shipment	Sold to Local Trade and Employes	Used at Mine for Steam and Heat	Made into Coke	Total Production	Total Value	Average Price per Ton
Carbon.....	1,225,179	6,824	26,257	987	1,259,247	$1,574,168	$1.25
Summit.....	45,184	3,542	4,161	...	52,887	73,564	1.39
Uinta	.....	6,068	8	...	6,076	9.546	1.57
Emery and San Pete	2,485	1,899	20	...	4,404	8,804	2.00
Total.....	1,272,848	18,333	30,446	987	1,322,614	$1,666,082	$1.26

The increase of production for 1901 over that of 1900 is nearly fifteen per cent., and Carbon County still comes to the front with an output of ninety-five per cent. of the total production of coal in the State.

IMPORTS, EXPORTS AND CONSUMPTION OF COAL AND COKE IN UTAH FOR THE LAST FIVE YEARS.

COAL

	1899	1900	1901	1902	1903
Produced in Utah	786,049	1,224,156	1,382,470	1,638,829	1,762,178
Imports into Utah	291,831	344,818	342,395	403,190	343,314
Exports from Utah	522,536	606,608	648,081	755,060	817,954
Consumed in Utah	555,344	962,366	1,076,784	1,286,959	.....

COKE

	1899	1900	1901	1902	1903
Produced in Utah	26,671	35,013	50,620	139,765	162,204
Imports into Utah	20,473	4,032	2,800	1,730	4,250
Exports from Utah	.....	1,869	2,569	55,906	48,661
Consumed in Utah	47,144	37,176	50,851	85,589	117,793

Coal of workable thickness is found in the Tertiary, the Laramie, the Bear River Laramie, and the Dakota formations, and the coal found in these divisions has been more or less worked in different portions of Utah.

In descending order, the localities of which mines are operated and the geological horizons in which they occur are:

Tertiary.—The coal in this group was the first to be worked in the Territory. In 1855, near the small town of Wales, in San Pete County, a small mine was opened, and Captain Simpson speaks of it in 1857 as supplying coal to all the settlements and blacksmiths far and near. In 1857 an attempt was made to make coke from this coal, and the experiments were continued intermittently till 1877. By crucible tests this coal afforded as high as sixty per cent. of coke, but in practice in Coppee coke ovens the production of coke never exceeded fifty per cent. Even then, owing to its poor quality and high percentage of ash, it was difficult to find a market for it, and coke making was finally abandoned in 1877.

The analyses of this coal and coke give:

	COAL	COAL	COKE
Moisture	1.16	2.05	3.30
Volatile Matter	32.91	31.08	5.05
Fixed Carbon	54.75	49.85	67.10
Ash	11.18	17.02	24.55
Totals	100.00	100.00	100.00

This same coal is also worked in Lake Fork, a tributary of the Spanish Fork, in Utah County, and sold to the settlements in Utah Valley. This coal again is worked near Henryville, in Garfield County, and attains its maximum thickness at this place, being about twelve feet thick.

Laramie.—This formation contains the greatest development of coal in Utah, and its distribution extends from Summit County in the north to Iron County in the south. The mines in and around Coalville are operated upon a coal bed from 8 feet to 10 feet thick, which occupies the division line between the Laramie and Fox Hill, the Laramie fossils being found in the roof of the coal, while Fox Hill fossils are found in the floor.

In this district there are two mines, which combined produce from 50,000 to 75,000 tons a year, namely, the Grass Creek and Chalk Creek mines. The analyses of this coal is fairly represented in the subjoined table:

	Grass Creek		Chalk Creek	
Moisture	8.97	9.00	4.30	6.50
Volatile Matter	43.54	41.58	46.37	41.70
Fixed Carbon	45.48	46.03	38.90	44.80
Ash	3.90	3.37	10.32	7.00
Totals	101.89	99.98	99.89	100.00
Sulphur	2.11	2.06		

In Carbon County large mines are operating at Winter Quarters, where the coal is from 9 feet to 18 feet thick, with an analysis as follows:

Moisture	3.20
Volatile Matter	45.67
Fixed Carbon	47.22
Ash	3.35
Sulphur	0.56
Total	100.00

At Scofield, where the coal is 28 feet 6 inches thick, and having the following composition:

Moisture	5.00
Volatile Matter	45.37
Fixed Carbon	45.23
Ash	4.40
Total	100.00
Sulphur	.73

At Clear Creek, where the coal has a thickness of 14 feet, and a chemical composition as follows:

Moisture	3.42
Volatile Matter	43.56
Fixed Carbon	48.38
Ash	4.64
Total	100.00
Sulphur	.68

At Castle Gate, where the coal varies from 5 feet to 10 feet in thickness. An analysis shows:

Moisture	1.68
Volatile Matter	44.29
Fixed Carbon	48.65
Ash	5.38
Total	100.00
Sulphur	.47

And at Sunnyside, where the coal shows the same variation as at Castle Gate, and the following analysis:

Moisture	.98
Volatile Matter	39.54
Fixed Carbon	57.84
Ash	1.64
Total	100.00
Sulphur	.55

There are in the same county several small mines operating to supply the local demands, and they also are operating upon the same vein.

The same measures extend through Grand County, from Green River to the Colorado-Utah line, and also through Emery County, in both of which Counties there are a number of small mines operated for the supply of the local demand.

VEIN OF COAL EIGHT TO NINE FEET THICK
Exposed in Huntington Canyon, Utah

The same measures are exposed in Sevier County, but there are no mines that have been opened, although a good deal of prospect work has been done exposing good, thick, workable veins.

In San Pete County, at Morrison, a few miles south of Manti, the same coal is found and is operated by the Sterling Coal & Coke Company, of which the following analyses show the average composition:

	TOP COAL	MIDDLE COAL	BOTTOM COAL
Moisture	7.07	7.15	6.38
Volatile Matter	43.18	42.74	42.60
Fixed Carbon	44.07	45.60	45.46
Ash	5.68	4.31	5.56
Totals	100.00	100.00	100.00

In Iron County this same coal series is found near the top and skirting the southern and eastern edge of the Pahranahat Plateau. Here the thickness runs from 6 feet to 18 feet, the average composition of which is found in the following table:

ANALYSES OF COAL FROM NEAR CEDAR CITY, UTAH

	Specific Gravity	Sulphur	VOLATILE MATTER		Fixed Carbon	Ash	Carbon in Volatile Matter
			Moisture	Other Volatile Matter			
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Leyson Claim	1.34	1.79	4.50	39.90	45.47	10.12	22.62
Woods Claim	1.34	(a)	3.33	41.62	47.37	7.67	24.54
Walker No. 2	1.36	2.36	4.12	40.15	45.82	9.90	23.47
Lone Tree Claim	1.31	2.45	8.17	38.55	47.27	6.00	21.09
Pollock Claim	1.35	(a)	7.87	38.15	46.25	7.72	20.17

a No determination made.

In the foothills of the Henry Mountains coal of this same series is found immediately beneath the blue gate sandstone. Owing to the proximity to igneous intrusions, it is in places altered to an anthracite, but being far distant (about 100 miles) from any existing railroad, and out of the possible line of future railroads, this field is not receiving much, if any, attention from any one interested in coal. The analysis shows an excellent grade of anthracite, which would be very acceptable to the fuel consumers of Utah and the surrounding States; still it would require a very large outlay to reach it with a railroad and open up mines ready for the supply of the trade.

Bear River Laramie.—The coal of this formation commences upon the Muddy Creek in Emery County, and extends in a sinuous line to Cainville, swings around the Henry Mountains to the south, and crosses the Pahriah River and Virgin River, Zion Creek, a tributary of the Virgin, and skirts the east side of the Pinto Mountains from New Harmony to near St. George. The writer has been on this coal at intervals throughout its entire exposure of outcrop, and finds it from 6 feet to 22 feet 6 inches in thickness, but as a rule finds it somewhat inferior in quality. Near New Harmony, owing to proximity to the eruptives, it has been altered to an anthracite. Many years ago some prospect work was done upon this anthracite exposure, and at the present time Mr. Robert A. Kirker is developing this bed rather energetically, but with what success the writer is not familiar at the present time. Mr. Kirker claims that he has two veins of anthracite, each of them four feet thick. According to an analysis furnished by Mr. Kirker, it has the following composition:

Moisture	1.28
Volatile Matter	12.58
Fixed Carbon	70.11
Sulphur	4.38
Ash	11.65
Total	100.00

An anaylsis of the unaltered coal of this group gave the writer the following:

Moisture	15.04	Ash	7.00
Volatile Matter	36.14	Total	100.00
Fixed Carbon	41.82	Sulphur	2.07

Dakota.—The coal of this group has its greatest development in the vicinity of Vernal in Uintah County, and is there worked to an extent of from 5,000 to 10,000 tons a year, all of which is sold to the settlers of Vernal and the surrounding country. Fort DuChesne is also supplied from this source.

EIGHTEEN-FOOT VEIN OF COAL, EMERY COUNTY, UTAH

This same coal is found in Grand County, but it does not seem to occur in veins thick enough for mining operations.

When the Denver & North Western Railway, the San Pedro, Los Angeles & Salt Lake Railroad, and the Western Pacific Railway are completed and in operation, they will open up an extensive new field for the use of fuel, not only for the railroads themselves, but for the population of the country through which they pass. Nearly all of this new demand for fuel must of necessity be supplied by Utah, as neither Idaho, Nevada, California nor Arizona have coal within their boundaries.

The coal of Utah will compare most favorably with coals of other States, or even Canadian coals, and it has the additional advantage of geographical position, so that there is no good reason why Utah should not supply the intermountain region of the United States.

For comparison, the analyses of several coals are attached hereto:

LOCALITY	Moisture	Volatile Matter	Fixed Carbon	Ash	Total	Sulphur
Almy, Wyoming	5.83	37.40	49.31	7.46	100	....
Rock Springs, Wyoming.	7.72	40.88	50.19	1.21	100	.38
Jerome Park, Colorado..	2.41	35.70	50.29	11.60	100	....
" " "	2.46	32.68	49.22	5.64	100	1.32
Crested Butte, "	2.51	37.10	51.87	8.52	100	....

Building Stones

The term "building stones" as used in trade and commerce is of wide application, including all materials of structural utility, such as stone used for building purposes generally, and materials for fences, monuments, bridges, etc. It is by common usage in statistical reports intended to comprise clays, cement material and ornamental stones, exclusive of gems.

But few building stones in the world are utilized in their raw state for other than local application. Practically every section of our own country produces its local supply. However, material of particular excellence may be and is utilized beyond its limits of occurrence.

Utah is rich in structural materials of superior quality, and in abundance to meet all demands.

Granite in a general sense comprises not only the rock of that name, as classified by the lithologist, but many allied species such as diorite, diabase, syenite, gneiss, and even dolerite and gabbro.

The widely known occurrences of granitic rock in Little Cottonwood Canyon are of first importance. This rock is essentially a syenite, or more specifically a dioritoid granite. It has been designated as Temple Granite by the official geologists, in reference to the great Temple in Salt Lake City, which is constructed of this material. The rock constitutes the greater part of the colossal mountain mass, and its abundance is beyond computation or estimate.

Granite rocks of allied composition and similar quality occur in Beaver County and elsewhere to the south, while the gneiss of Farmington Canyon and the dioritoid rocks of Ogden Canyon and vicinity on the north are of great and growing importance.

Sandstones of special excellence occur in Salt Lake, Utah, and adjoining counties, and in smaller quantity in practically every county of the State. The bright colored sandstones of Red Butte Canyon, near Salt Lake City, and the gray Kyune sandstone from Spanish Fork Canyon, have been used in many of the most imposing buildings of the metropolis and other cities.

Limestone constitutes the main bulk of the Wasatch Mountains and other Utah ranges. The variety specifically known as Wasatch limestone is an excellent building material, and is used also as a flux in smelter processes. It is so rich in calcium carbonate as to be in demand for the production of carbonic acid gas in the sugar factories of the State. A variety of limestone occurring in San Pete County and elsewhere is oolitic—that is, composed of small globular particles resembling fish eggs, hence its name—oolite. Some of the most pretentious residences of Utah cities are constructed of this beautiful stone.

Marble, really a crystalline variety of limestone, is found in Cache, Box Elder, Salt Lake, Utah and southern counties.

Utah Onyx, also a calcium carbonate, but of such beauty as to preclude its use as a building stone proper, and to insure its popularity as a material for interior decoration, is found in great quantity. Box Elder, Salt Lake and Utah Counties are the principal producers. The elegant wainscot in the corridors of the City and County Building, Salt Lake City, is of Utah onyx from the Pelican Point deposits on the shores of Utah Lake.

Concretionary Marble, otherwise known as nodular limestone, occurs in quantity incalculable at the head of Hobble Creek Canyon, near Springville, Utah County. This rock is of surpassing beauty as a building material, being made up of concentric nodules, from the size of a pea to that of a walnut, firmly cemented together. It takes a superb polish and is in demand as an ornamental stone.

Slate of excellent quality is quarried in Slate Canyon, near Provo City. It promises to displace the time-honored shingles, so common in the West, as a roofing material.

Volcanic stones, such as basalts, trachytes and tuffs, are used extensively for building materials in Beaver County and elsewhere, while in the southern counties they are employed as excellent foundation stones for even the largest buildings.

Ornamental Stones.—Beside Utah Onyx, already named, the principal ornamental stones and minerals occurring within the State are: Malachite and azurite

TUNNEL NO. 3 ON UNION PACIFIC RAILWAY, WEBER CANYON

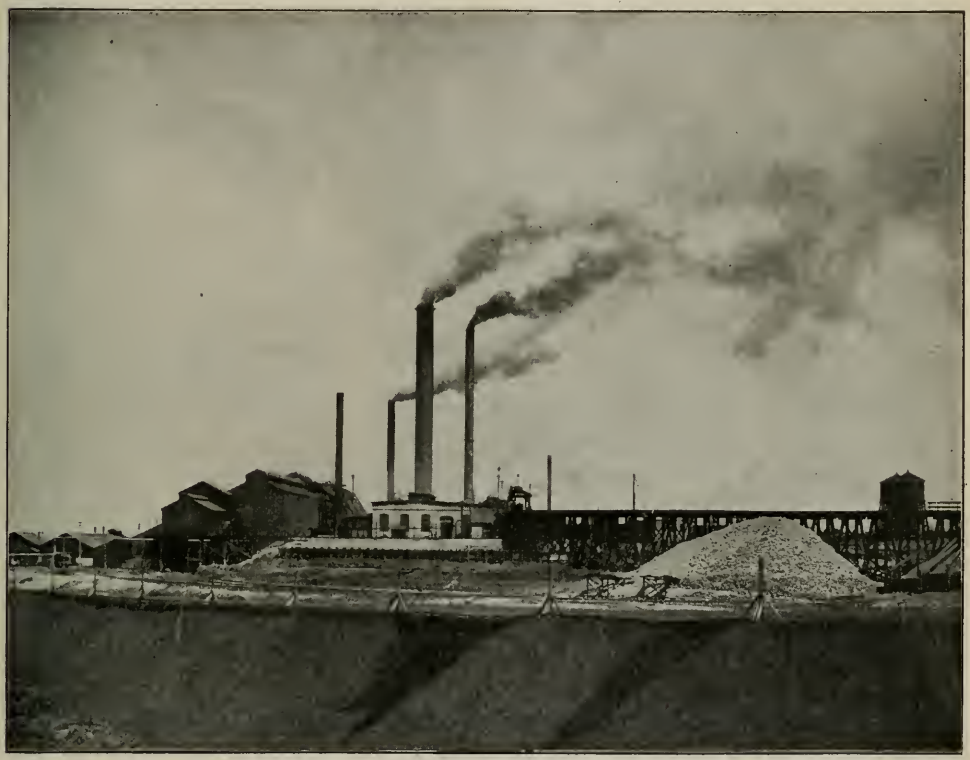
(green and blue copper-carbonates), alabaster, satin spar, moss agate, chrysocolla (copper silicate), feldspar, jasper, silicified wood (petrified wood), and serpentine.

Clays of many varieties are of extensive occurrence, and are now in use on a fair scale for the production of common and pressed brick, fire-brick, fire-clay preparations generally, pottery, and cements both natural and artificial. Utah exports an excellent quality of Portland cement.

Gypsum occurs as plaster-stone, alabaster, satin spar, and in the crystallized state as selenite. The huge crystals of selenite from the Wayne County deserts are alone of their kind in the world. Factories for the production of plaster-paris and other gypsum preparations are in steady operation at Nephi and other points.

Smelting

About 2,000 men find constant employment in the smelters in Utah. This does not include those engaged at the Majestic, near Milford, in Beaver County, when that plant is in operation, but now temporarily closed pending an adjustment of difficulties of a financial nature. There are seven smelting plants in the State. These are the American Smelting and Refining Company, employing about 750 men; the Highland Boy, or Utah Consolidated, 250 men; the United States, 500 men; the Bingham Consolidated, 250, all in Salt Lake Valley; the



SMELTER OF UNITED STATES SMELTING COMPANY

Yampa, in Bingham, 100 men, and the Utah Eastern & Copper Company, in Washington County, 40 men. The Majestic, when in full operation, will employ 125 more men, so that the aggregate number of persons finding employment in this industry is at present practically 2,000.

These smelters have a capacity for handling in excess of 3,000 tons of ore daily. This ore the mines are unfailingly supplying, while construction work to increase the size of the plants so as to handle a materially increased tonnage, is now in progress on the Utah Consolidated. Manager R. H. Channing states that the additions will give an increased capacity of 50 per cent., or a maximum of 750 tons daily, all of which comes from its own mines. The United States Smelting Company (same as the United States Mining Company) is now constructing an independent smelter, near the site of its present plant, which will be employed

in the reduction of lead ores exclusively, as its present plant is exclusively utilized for the handling of copper ores. The new plant will have a capacity of 350 tons of lead ores daily, which will give a total maximum increase of its present capacity in excess of 50 per cent.

As already stated, the Utah Consolidated (Highland Boy) handles no ores but those produced in its own mines at Bingham, and it is a copper smelter, pure and simple. This is true also of the Yampa smelter. The Bingham Consolidated plant likewise treats only copper ores, and the same applies also to the present active smelter of the United States. That the Bingham Consolidated smelter will follow the United States in preparing to treat lead ores seems to be assured. The American Smelting and Refining Company handles ores of all classes, and is a bidder for all mine products that will smelt. Upon the completion of its lead smelter the United States smelter will be a competitor for custom ores, as will the Bingham Consolidated when it shall have erected a plant for the reduction of lead ores. At present all the plants save that of the Highland Boy, are bidders for the ores they are prepared to reduce. As a consequence the owners of copper bearing mines secure the very best obtainable figure for the product of their mines; and once the United States and other smelters are ready for the treatment of lead ores, the same desirable conditions will apply to owners of all producing properties whose ores must be smelted.

That the past year has been a prosperous one for smelting interests is attested in the most conclusive manner—by the erection of new plants and by increasing the capacity of those already in operation.

It must not be presumed that the capacity of the smelters indicates the tonnage of minerals produced in the State. While these can handle approximately one and a quarter millions of tons annually, the tonnage is greatly in excess of this, since all ores that are cyanided are not included in the smelting tonnage.

The Annie Laurie mine reduces annually over 100,000 tons of ore by the cyanide process, and the Consolidated Mercur yields at its present output close on 300,000 tons annually—and this is 33⅓ per cent. below its capacity and former record. To this total tonnage reduced by this process must be added that of the Sacramento Gold Mining Company, the Johnny of Stateline, and the Century of Park Valley.

Not only has the profit from smelting induced an increasing capacity on the part of smelters, but the fast growing output of the State's mines makes it absolutely imperative. Besides the unexampled growth in tonnage from Bingham, as shown in the operation of the mines of the Utah Copper Company, the Boston Consolidated, the Yampa, the Bingham and New Haven, the renewal of operations at the Mammoth at Tintic, and the vast tonnage now beginning to come forth from Stockton as a result of the drainage of that area by the Honerine tunnel, must all be taken into account. Within ninety days the tonnage from Bingham has doubled. In six months more it is practically certain to be doubled again. Then Alta is coming forward with a product that will swell from month to month until its output shall become a vital factor in the volume of ores of the State. What the unwatering of the boundless ore bodies in the neighborhood of Stockton by the great Honerine tunnel means, it is impossible to estimate, but so important is it that the taking care thereof is a problem that is already before the smelters.

It necessarily follows, therefore, that the development of smelting interests in Salt Lake Valley alone is a consideration of the most vital importance in the economics of Utah. And this, too, as it indicates a demand for increased labor in mines corresponding to the added demand for labor for the smelters, and all the State will share in the benefit thereof.

Within a brief space Utah has taken fourth rank as a producer of precious metals in the United States, and her smelting interests must necessarily keep pace with the mining developments.

Mining—General

LIKE all other industries, mining has its vicissitudes. A very slight fluctuation in values has made or unmade prosperity in the production of all metals save gold—the value of which is fixed. There have been, therefore, dark days in the mining history of this as of other States—and in times gone by the great industry has seemed on the point of being wiped out, first by the great fall in the price of silver, and again by diminished returns for lead. As, in this State, silver and lead are generally found together and mined by one operation, it follows that any change in the price of the one metal affects vitally the profits in producing the other. So they are united in prosperity and in adversity.

The present assurance of adequate returns in mining is not, however, due so much to any enhancement in the price paid for either silver or lead, or for both—though this is of no little importance—as to cheaper methods of mining the ores and reducing them.

Metallurgy has kept pace with other sciences, and discovered and devised ways for the removal of what at one time were fatal reduction obstacles. It has also suggested devices for handling more economically the product of mines. This applies as well to the extraction of ores as to their reduction after they have been extracted. To the science of metallurgy and to the introduction of labor saving methods in mining, therefore, may be credited the greater mineral product of the West. These have had still another effect—that of increasing the assurance of returns from investments in mining, without which all industries must despair of continued and faithful support. Wider geological knowledge of mineralized areas has also been a vital factor in removing much of the hazard that formerly attached to mining as an industry, and as this knowledge widens, and it is more and more

JUDGE C. C. GOODWIN
Formerly Editor Salt Lake Tribune. A man who, as a writer, has done more for mining than any other person in the West

generally applied to known mineralogical and geological conditions in areas inviting investment, the returns are destined to be more and more certain. So side by side, wider geological knowledge, more modern labor saving appliances, and more economical and scientific metallurgical methods will labor to a common end, and the result will be the profitable operation of properties now commercially valueless (because of the absence of the favorable conditions above named), greater profits from the operations of properties already yielding encouraging returns, and the

THE PROSPECTOR—BY LUKE CRAWSHAW

steady growth, by these several means, of the barrier between the industry and the unhealthy effect of varying prices for the product of mines, whether stimulated because of increase, or depressed because of decreased prices.

And that all this diminishes the hazard and increases the assurance of returns from intelligent investment in mining, goes without utterance.

Mining in Utah has barely commenced.

The most distinctive feature of mining in Utah in the past few years—and particularly in the last twelve months—has been the development of the State's copper resources. This has been little less than phenomenal. To Bingham canyon ores this development is due and the results of the operations of the Highland Boy (Utah Consolidated) mines and smelters has done more to draw attention to the opportunities that camp afforded than anything else. Besides the steady output of the Bingham Copper and Gold Mines, and that of the Highland Boy and the United States Mining Companies, the Yampa, the Utah Copper,

and the Boston Consolidated have increased the tonnage therefrom fully 50 per cent. in the past six months. The Highland Boy and all the properties named will also increase their output at least 50 per cent. more in the next few months, while the Utah Copper Company, instead of shipping to its concentrator 600 tons daily, expects to handle up to 3,000 tons, and even beyond this, of its own ores daily. And all this is yet to be augmented by the output of the Cactus at Beaver and other properties in the same section.

Mining in Utah has barely commenced.

Iron

Utah will produce iron and steel for the future trade of the Pacific coast and of the Orient.

If China ever inclines toward Western Civilization, it will be when her once crumbling empire has been bound together with ten thousand miles of steel rails made in Utah and from iron produced in this State.

Untold thousands of tons of this iron will be used in advancing the civilization of Russian country and the far off Indies, and the Philippines and Japan and Australia will, for geographic and economic reasons, buy millions of tons of iron in Utah. The day is not far distant when all the islands of the mighty Pacific will send to this mountain locked empire for iron for their bridges and rails and structural steel of all kinds.

GREAT WESTERN-BLAIR IRON OUTCROP—IRON COUNTY, UTAH

An attempt to exaggerate the value of this one undeveloped resource were as hopeless as an attempt to overestimate the value of the Nile to Egypt; in either case the cold, hard facts are practically beyond the powers of the ordinary intellect to grasp.

Iron ore is found in various parts of this State. A good fluxing iron containing about $2 gold to the ton is mined in the Tintic district, Juab and Utah Counties, and shipped to the smelters in Salt Lake valley, but the only deposits of real commercial importance are those north of Salt Lake City, in Weber county, and the far more extensive ones of the southern part of the State. It is thought that a consideration of the last named will be sufficient for the purpose of this article.

In southwestern Utah, about 200 miles from Salt Lake City and less than 500 miles from the deep water harbor of San Pedro, California, are, according to the careful estimates of some of the world's greatest experts, over 500,000,000 tons of iron ore in sight. This immense deposit covers an area of fifteen miles long by three wide, and is within cannon shot of the San Pedro, Los Angeles and Salt Lake Railroad. The ore averages 62 per cent. metallic iron and in silica it runs to 7 per cent., while the adjacent limestone has all the proper fluxing qualities necessary for perfect reduction. There are three large blow-outs on this vast metallic range, where the pure iron stands black and magnetic waiting the coming of capital and human energy to carry it to the furnace and mold it into the thousand various iron commodities of civilization. Hundreds of acres of this deposit will require no stripping to lay bare the wonderful deposits and, except where the ore outcrops, it is a soft red and brown hematite.

Mr. A. B. Dear, of the firm of Winston Bros. & Dear, Duluth, estimates that this ore can be stripped, mined and placed on cars for fifteen cents per ton.

This is said to be the largest surface showing of iron known. Experts from all parts of the world have gone over this ground time and time again, and at last one of them, representing Mr. John W. Gates, after camping on the ground for six weeks, pronounced it by far the greatest deposit of iron ore ever disclosed, and this, too, after making the statement that he had inspected every iron deposit of consequence on the face of the earth. Other experts have estimated the possibilities of iron here to be over a billion tons, and they say at least 25 per cent. of this is Bessemer, the balance being Basic. If the two ores were mixed it would greatly increase the per cent. of the former.

When the foregoing estimates are considered in connection with the fact that Utah has mountains of coke producing coal, and that other fact that tide water is only 425 miles away, the force of the statements heading this subject can be appreciated.

Not long since Mr. John T. Jones, one of the best known iron experts in the United States, spent several weeks looking over the Utah fields. Here is what he says:

"Within a few years Utah should be producing more iron than any other State in the Union. The deposits in the southwestern part of the State are the greatest I have ever seen, and I have examined all the principal iron deposits in the United States, Cuba and Venezuela.

The close proximity of the iron to an ample supply of fuel and lime flux makes it possible to produce iron in Utah cheaper than anywhere else in the United States. Iron works can be erected in this State which will produce iron so cheaply that, with fair railroad rates, the finished product can be laid down in Chicago on at least equal terms with the product of the United States Steel Corporation or any other producer. The low cost of production would make it possible for the Utah iron and steel works to control absolutely the trade of the western part of North and South America and the Orient.

The following is an extract from the report of Geo. E. Gunn, expert of the American Smelting & Refining Company:

"General Formation.—Granite, limestone, sandstone and quartzite.

"Formation of Veins or Ore Deposits.—In this respect, in describing one mine I might as well include the whole district.

"A range of granite hills, having a northeast and southwest course, traverses the county for a distance of fifteen or twenty miles. The width of granite varies, in places being several miles wide, while in other places it is contracted to much less than a mile across, this contraction probably being due to the sedimentary formations overlying the granite not being eroded away in the low places, as much as where the hills are more precipitous and higher.

"The iron deposits seem to follow on both sides of this granite, sometimes occurring on the contact between the lime and granite, again occurring in the limestone near the granite, while in other places they are located in the granite, and occasionally between the quartzite and lime, but in all cases, as far as present developments show, they have fairly perpendicular walls.

"While all the iron ores carry some percentage of magnetic, yet in the limes and on the contacts the iron is largely hematite, while in the granite the iron is magnetite.

"Apparently these granite hills were made by either upheaval or contraction. In the disturbance, fissures were made in places in the granite, afterward filling with ore. At the same time the ground along the contact was disturbed and

OUTCROP OF IRON—IRON COUNTY, UTAH

fissured. Water coursing along these contacts eroded the limestone, causing caves which afterwards filled with ore. In one place, about the center of the range, there is a break, causing a flat valley some four miles across, which is now covered with debris and upon which no work has been done. Undoubtedly the iron bodies go across this valley, and under which there undoubtedly exists large bodies of ore."

The Hon. Bayard F. Putnam reports on the Utah Iron fields in the Tenth United States census, and among other things he says:

"In extent of its iron deposits Utah may be considered the most favored region west of the 100th meridian."

With reference to the quality of the Utah ore, Mr. Putnam included in his report the following analyses from thirteen samples taken from as many claims scattered over the entire field. These samples were numbered in his report 1141 to 1153 inclusive.

Sample No.	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153
	%	%	%	%	%	%	%	%	%	%	%	%	%
Metallic Iron	57.55	61.43	67.81	64.09	61.64	67.09	63.21	65.48	67.09	68.06	59.41	67.31	68.44
Phosphorus	0.248	0.198	0.113	0.264	0.425	0.080	0.182	0 064	0.093	0.059	0.066	0.057	0.038
Phosphorus in 100 parts of Iron	0.431	0.312	0.167	0.412	0.689	0.119	0.288	0.098	0.139	0.087	0.111	0.085	0.055

Captain C. E. Dutton, Ordnance Corps, U. S. Army, made two analyses of ore from this region, which were published in Vol. III of Lieutenant Wheeler's report of explorations and surveys west of 100th meridian. They are as follows:

ANALYSIS.

	Red Hematite Ore	Magnetic Ore
Insoluble residue (silica and silicates)	3.34	3.81
Magnetic Oxide of Iron, Fe_3O_4	5.64	67.68
Peroxide of Iron, Fe_2O_3	82.97	28.00
Water	6.06	0.10
Alumina	1.35	0.38
Manganese	.....	Trace
Sulphur	0.06	None detected
Phosphoric Acid	0.19	None detected
Lime	0.33	
Total	99.94	99.97
Metallic Iron	62.16	68.61

It is impossible to fully grasp the future importance of the iron industry to Utah. That the possibilities and probabilities in this line are stupendous all who are familiar with conditions must concede. The inactivity of the frost cannot be maintained much longer. The brooding silence of the centuries must soon be disturbed by the sound of drills and the shrill cry of steam whistles, and Utah must go where destiny points, and in doing so lead in the front rank of iron and steel producing States. And what will this mean to Utah and the West? Who can say? Think of China's four hundred millions of souls shaking off their slumber and becoming a progressive race! Think of Japan's growing importance, of Australia's urgent need of iron and steel; of Russia's thousands upon thousands of miles of projected roads yet to be built and then, realizing that Utah can "absolutely control" the iron trade of the Far East, try and picture the result to this State and to the West.

At the present time the Pacific coast buys 300,000 tons of rails and 480,000 tons of pig iron annually, for which she pays in round figures the sum of $31,000,000. Think what it would mean to Utah if she had this amount each year from her iron mines with the prospect of being able to multiply that figure significantly within the next ten years.

According to statistics it costs the United States Steel Corporation $7.20 and upwards per ton to make Bessemer pig iron, which is the base of iron and steel products. Pig iron of equal quality can be made in Utah for from $4.72 to $6 per ton, and the finished product can be placed on the docks at tide water for one-half what it costs to ship it from Pittsburg. San Francisco pays $48 a ton for her steel rails; given an up-to-date steel plant Utah could make them at $13 per ton. The price of steel rails in Pittsburg to-day is about $28 a ton; Utah could lay them down on the Pacific coast for much less and still pay enormous dividends.

A proper question would be: "Why does not Utah manufacture these articles?" The answer is simple as the question: "Because the great captains of finance and industry have, until recent years, given little thought and no study to Utah and her resources."

But by dint of constant telling the attention of certain steel kings was at last gained, experts were in time sent out to report and when they did so they confessed that in so far as the iron ore was concerned, the truth had not half been told. "But," the experts continued, "there is no direct transportation line to the coast, and though adjoining counties have mountains of coal, it is not coking coal."

Time rolled on. Other experts came, and elaborate tests were instituted to demonstrate that Utah coal would make the proper kind of coke. These tests were entirely successful in establishing the fact that plenty of coking coal could be had in this State.

The direct transportation objection has been met and swept aside by the San Pedro, Los Angeles and Salt Lake Railroad from Salt Lake to Los Angeles and San Pedro harbor. This road is soon to be completed. In another year through trains should be running over it, and they will pass through the greatest iron fields on earth; and practically touch coal fields almost as vast.

And this is what it means to Utah and the West:

Cheaper iron and steel with a corresponding increase of consumption.

A prodigious stimulating of the ship building industry on the Pacific coast.

A new city in Utah whose destiny will be brighter and more promising than that of Pittsburg, a city starting out with a pay roll of over $3,000,000 annually.

It means the multiplication of railroads, the opening of greater and vaster mines, an added stimulus to all agricultural interests, the revolutionizing of manufactories and employment of thousands upon thousands of men. It gives a justifical for the proposed reclamation of millions of acres of lands now barren and desolate.

Sulphur.—The sulphur mines of Utah, located at Cove Creek, in Millard County, have produced 20,000 tons of refined sulphur, valued at $450,000. The deposits are of a blanket formation caused by volcanic action. The mines are not worked extensively on account of the cost of extraction. These deposits were declared, at one time, by experts to be the most valuable in the world, but they did not prove to be as extensive as at first estimated. The product is of high grade and equals the best from Sicily.

KNOWN DIVIDENDS PAID BY UTAH MINES FOR 1903.

Annie Laurie	$ 200,000
Butler Liberal	2,500
Century	8,500
Consolidated Mercur	150,000
Daly West	1,332,000
Gemini	100,000
Grand Central	225,000
Horn Silver	20,000
Ontario	45,000
Silver King	1,300,000
Sacramento	60,000
South Swansea	9,000
Utah Mining Company (Fish Springs)	8,000
Utah Consolidated	1,404,000
Total	$4,864,000
This does not include profits made by properties worked privately, nor profits made by leases, which aggregated, conservatively estimated..	500,000
Grand total	$5,364,000

TOTAL OF REPUTED DIVIDENDS OF UTAH MINES.

Anchor	$ 525,000	Brought forward	$22,543,777
Ajax	1,000,000	Highland Boy	1,725,000
Annie Laurie	290,000	Horn Silver	5,397,000
Bullion Beck	2,479,400	Mammoth	1,860,000
Butler Liberal	2,500	Maxfield	118,000
Carisa	105,000	May Day	30,000
Centennial Eureka	2,747,700	Ontario	13,932,500
Chloride Point	5,000	Petro	33,000
Century	18,000	Quincy	1,187,500
Consolidated Mercur	3,635,312	Silver King	7,750,000
Crescent	280,000	Silver Shield	4,500
Dalton & Lark	244,225	Sacramento	193,000
Daly	2,925,000	South Swansea	284,500
Daly West	4,108,500	Swansea	306,500
Dixie	15,000	South Godica	1,000
Eureka Hill	1,850,000	Utah Consolidated	3,929,000
Galena	71,090	Utah (Fish Sp.)	218,000
Geyser Marion	96,000	Uncle Sam	45,000
Grand Central	991,250	West Mt. Placer	5,481
Grand Gulch	4,800	White Rock	4,000
Gemini	1,150,000	Yankee Con.	75,000
	$22,543,777		$59,642,758

UTAH'S MINERAL OUTPUT FOR 1903.

147,713,120 lbs. of lead at 4c per pound	$ 5,908,524.80
37,909,740 lbs. of copper at 13.351c per pound	5,061,329.38
19,425,694 ozs. of silver at 53.22c per ounce	10,338,354.35
257,940 ozs. of gold at $20 per ounce	5,158,800.00
Total	$26,467,008.53
Utah mines paid in dividends in 1903	$ 4,864,000.00
Unreported mines and leases (estimated)	500,000.00
Total dividends	$ 5,364,000.00

UTAH'S MINERAL OUTPUT SINCE 1869.

Total gold production from 1877 to date	$ 35,758,213.26
Total silver production from 1877 to date	161,862,224.48
Total lead production from 1877 to date	53,285,513.74
Total copper production from 1877 to date	18,146,707.53
	$269,052,659.01
Total gold production from 1869 to 1877	1,712,116.00
Total silver production from 1869 to 1877	19,798,004.00
Total lead production from 1869 to 1877 (estimated)	10,756,610.00
Grand total	$301,319,839.01

This estimate of lead is based upon the average production of lead in proportion to gold and silver produced, as given in Mining Statistics.

TOTAL GOLD AND SILVER PRODUCTION.

Total gold	$ 37,470,329.26
Total silver	181,660,228.48
Total gold and silver	$219,130,557.74

Mining Districts

Park City and Alta Areas

The mining districts embraced in the Park City area, in the region at the head of Little Cottonwood and Big Cottonwood Canyons, and of American Fork Canyons, cover a territory between fifteen and twenty miles square. The mineral riches held in the depths of this area no human being can begin to conceive.

The history of these several camps is, in some respects, not unlike that in the southern part of the Tintic district in the discouragement at one time experienced by the change in the character of the ores from the oxidized to sulphides.

Alta

Alta, in Little Cottonwood mining district, occupies relatively the same position to Salt Lake valley as Bingham. It is on the east side of Salt Lake valley and up in the mountains, while Bingham is on the west side. The fame of Utah's riches was first given general publicity through the mines of Alta. Here the once noted Emma mine, which at one time came near being the subject of complications between England and the United States, because of its English ownership, is located. It has produced $7,000,000 in precious metals. Here also are situated the Flagstaff and many others, at one time operated and which produced ore of astonishing values.

At the time the camp was actively producing ores the cost of transportation and reduction charges were so much higher than to-day that there is practically no comparison. The method of handling sulphide ores was so much inferior than now, that the presence of sulphur practically destroyed their commercial value. Generally speaking, as soon as the water level was reached, the oxidized ores disappeared and were replaced by sulphides. In other cases the oxidized ores lost much of their values, and the result was that a camp once as noted as any in the West, producing a grade of ores averaging high in values, was practically abandoned and so remained for twenty years or more.

The same conditions prevailed in Park City, and especially in the Ontario mine was the presence of the lean streak that lay between the ores truly oxidized and those containing sulphide, nearly disastrous. It is said the directors at one time determined to shut down the Ontario, and were only kept from doing so because Mr. Pat Kerwin, superintendent, said he would resign unless they consented to his sinking 200 feet below the point the shaft had at that time reached. A reluctant consent is what saved the Park district from abandonment, won for the Ontario her great record, and gave assurance to those who looked toward Alta in the faith that greater depth would disclose a reappearance of the rich ores that made the camp famous before the water level was reached.

Mr. Tony Jacobson and Mr. Arthur E. Snow, associated with others, began work with the faith mentioned, and the Columbus Consolidated Mining Company, erected on the remains of abandoned producers, is a property that now discloses ore bodies of a value fully equal to $3,000,000, and developments have but begun. In every case prospecting, when carried far enough, has brought about the same result. Mr. H. W. Crowther, in the Continental-Alta group, has also added several abandoned properties to the list of precious mineral producers of the State, and prospecting is daily adding to the ore reserves in this group.

The Albion, Superior-Alta, South Columbus, the Copper Prince and other successful companies are building on the supposed ruins of old claims. It is characteristic of Alta that the ores gain in average values with depth, though pockets of sensational richness are not so frequent as when the oxidized ores were being worked.

As Alta is but sixteen miles from the smelters of Salt Lake valley it enjoys advantages that promise to make it equal to its neighbor—Park City—which lies five miles to the east—as to tonnage and dividends in the near future. Silver and gold, copper and lead are its chief metals.

Three years ago not ten men were employed in the camp. Now there are nearly three hundred, and this number will be vastly increased during the present season. The Columbus Consolidated Mining Company has, as is shown under the article on "Water Powers," a water power plant installed in Little Cottonwood Canyon with a maximum capacity of 700 electrical horse power. This is to be added to until it will reach 1,000 horse power. This power will be utilized by the company owning it up to its needs, and the balance sold to others, and so make the work of the camp more general by supplying cheaper power. All ores can be run from the mines in the camp to the valley smelters by gravity.

What applies to Little Cottonwood or Alta applies also to Big Cottonwood, in which new work is being prosecuted lately with gratifying results, as shown in the Scottish Chief, and also to American Fork Canyon district, which has not yet shown the effects of the revival of interest that applies particularly to Alta.

Park City and Adjacent Mines

Park City, over 7,000 feet above sea level, has a population of nearly 7,000 and every modern public convenience. It owes its origin and existence to the mines that surround it on every side but the north. The beginning of mining in this quarter is put at 1872, when Rector Skeen discovered the now famous Ontario mine, which he sold to Messrs. Hearst, Chambers and others for $30,000. Since that time the mine has produced close on to $34,000,000, and paid nearly $14,000,000 in dividends, and is still producing. The Daly, Daly West, Anchor and other mines were subsequently developed—the latter now forming part of the large Daly-Judge group.

Not less conspicuous now as producers than the Ontario was in its palmiest days (and this despite the fact that silver, the chief product of the camp, has fallen over 50 per cent. in value) are the Silver King and the Daly West mines, the extent and richness of whose ore bodies are, among precious metal producers, the wonder of the times.

So far as the geological formation is concerned, the features peculiar to the area surrounding Park City are shared by mines in the Big and Little Cottonwood —the latter known as Alta—mining districts, and by American Fork and Snake Creek districts, and for that reason familiarity with one gives knowledge practically as to all the districts named. It may be well to state that all these districts are contiguous to each other and really constitute one large mineralized area in which silver predominates in value, with lead, gold and copper also occurring, and occurring in value in the order named.

Writing of this district in "Contributions to Economic Geology," issued by the government in 1902, Mr. J. M. Boutwell has this to say:

"Park City ores do not appear to be generally distributed throughout the region in small amounts, but rather to be localized in certain well defined occurrences in large bodies of paying grade. Three main types of occurrences have been recognized—fissure ores, replacement ores and contact ores. In the first the

ore carries either silver and lead, with or without zinc and gray copper, or gold with some silver, and occurs between well defined fissure walls. In the second, the ore holds silver and lead values chiefly, and takes the form of elongated lenses within limestone, roughly parallel to the bedding. In the last the ore contains copper and gold, with or without lead and silver, and forms in irregular masses, pockets, lenses, and pencils in metamorphic limestones adjacent to intrusive bodies. Gold values appear to run highest in certain fractures in quartzite. Zinc is reputed to increase in the southwestern extension of the great fissure zone of the camp, and copper is said to reach its maximum amount in deeper portions of certain pseudo fissures in quartzite."

JOHN J. DALY

Despite the prosecution of extensive work and the expenditure of enormous sums of money, it was at one time believed that the Ontario and Daly were the only mines of any merit in the Park district, though the surface area for miles and miles in many directions had been located and the assessment work done year after year. Later the Anchor, now part of the Daly-Judge group, and the Crescent, at the present time included in the Keith-Kearns holdings, had begun to produce. The latter was abandoned for a time. Then came the strike in the Woodside, now part of the famous Silver King. The Daly West followed with most important discoveries and the disclosure of ore bodies of enormous extent and unusual richness. Following this was the discovery of ore of great value in the Quincy, a claim to which only a few had pinned their faith, and the Quincy was then absorbed by the Daly West, making it one of the most noted and valuable properties in the camp, and therefore in all the West.

Shafts have penetrated the ore bodies of the Ontario to a depth of over 2,000 feet, and these still maintain their width and average richness, all of which demonstrates beyond question the permanency and value of the ore bodies of this camp. The Silver King and Daly West have reserve ore bodies already developed which will justify the present production for years to come, and there is absolutely no question that further development will serve only to add to the continuity of these. Since 1872, with the exception of one brief period as the result of a fire, and another short time, when the fall in the price of silver in 1893 demoralized all silver mining conditions, the Ontario mine has uninterruptedly continued to pour forth its apparently undiminished treasures of very rich and lower grade

metals. This, for over thirty years. The future of such great properties, therefore, as the Silver King, Daly West and Daly-Judge cannot be questioned. Thus developments in the Quincy give warrant for the work now being prosecuted in, and an assurance of results to, the New York Bonanza, the J. I. C., Little Bell, Wabash, and American Flag and others in that portion of the camp, and to the developments prosecuted in the neighborhood of the Silver King in the Keith-Kearns group, and to the Comstock and California and others.

Notable among the younger producing properties is the Keith-Kearns, regarding which but little is generally said. This was formerly known as the Crescent, a property years ago among the dividend payers and located on Pinyon Hill, and was worked extensively for years and then shut down. Its present operation demonstrates the greater efficiency and economy of mining operations as compared with conditions that prevailed in the years gone by.

Recently a strike of the utmost importance in the old Daly, and that in a quarter generally assumed to be barren, has given promise of developing within the boundaries of the Daly ground practically a new mine, and, as like conditions prevail all through this district, this discovery, like that in the Quincy, assures new life to all the producers and prospective producers of the Park City district.

Five concentrating plants are in operation in the camp with a combined capacity for handling about 1,400 tons of ore daily. The Daly-Judge mill has 400 tons' capacity, the Silver King and Daly West each 300 tons; the Ontario 250 tons, and the Keith-Kearns mill 150 tons. All these handle inferior grades of ore—that is, ore which cannot with profit be shipped to the smelters.

Fully 1,000 men find employment in the Daly West and Silver King mines; and at least 1,000 or more are employed in other properties, the Ontario, Daly and Daly-Judge having over 500 between them. The average wages paid these men is not less than $3 per day. So the daily pay roll directly connected with the mines of Park City is $6,000 per day. As all these properties operate 365 days a year the annual pay roll of Park City mines is considerably in excess of $2,000,000.

The tonnage from the Park City mines is inferior to that of Bingham or Tintic, but the ores are so much richer that Park City mines in the past and at the present writing, pay more dividends than all the other mines in the State combined.

In many directions prospecting is steadily being prosecuted on a large scale. Great is the mining area that surrounds Park City, and its mines have only begun to yield. Yet it has given to the world in its existence over $70,000,000 in wealth.

West Mountain (Bingham)

The camp of Bingham, situate in Salt Lake County and within about twenty-seven miles of Salt Lake City, is in many respects the most remarkable mining district in the State, if not indeed in the entire Western mining region. Here was made the first important discovery of precious metal-bearing lead ores in the then Territory of Utah, more than forty years ago. About the same time the bed of the main canyon stream and its tributaries, Carr's Fork and Bear Gulch, were found to be repositories of valuable deposits of "placer" gold, and for many years succeeding these discoveries, a large number of miners found profitable employment in delving after the more precious metal, and it was not until the advent of the Union Pacific Railroad, in 1869, that any attempt was made to utilize the vast bodies of gold and silver-bearing lead ores that were known to exist within easy reach, in this now famous district.

The "Old Jordan" mine, now the most important of all the Bingham possessions of the United States Mining Company, it is said was the subject of the first mining location made in the northern part of the territory, dating back to the year 1863.

Professor A. F. Holden, late owner of the mine, and now managing director of the United States Mining Company, is authority for the statement that the gross value of the yield of ore from this single mine from the date of its discovery to the time when its ownership was acquired by the United States Mining Company, was more than eighteen million dollars, and that the whole of this large production was derived from workings which extend into the earth upon the dip of lode to a depth not exceeding sixty feet. To persons familiar with the nature of ore occurrences in the mountain regions this latter statement of Professor Holden will appear fabulous, but those who know him will not doubt his assertion. And when it is understood that the average silver contents of the ores was less than six ounces and that the gold values would not exceed one dollar per ton—the lead contents being the chief item of value—the enormous tonnage necessary to produce that vast sum is almost inconceivable. But this is not all, for since the United States Mining Company became possessed of the property some three years ago, in fact since the "blowing in" of their furnaces about sixteen months ago, probably a further production of a hundred thousand tons of cuprous iron sulphides have been added to the former yield of this grand old mine, and yet the greatest vertical depth attained is less than sixty feet below the surface outcrop of the lode. In fact the so-called "Clark-raise" and "Coolidge" stope from which the present company has drawn its chief daily supply for its smelter, although upon a continuation of the lode from its outcrop, and distant more than seven hundred feet therefrom, have in fact attained a vertical height of more than one hundred feet above the apex, or surface outcrop of the lode.

COL. ENOS A. WALL

But this latter statement requires explanation and is here alluded to in order to afford an illustration of one of the many difficult problems which confront the miner in everyday work, and which from lack of trained experience, supported by a knowledge of at least the elements of geology, so often results in disastrous failure.

Before entering upon a description of the peculiar condition found in this mine, and which are repeated in greater or less degree in many of the mines of the district, it will be well to first consider the general character of the rocks and vein formation of the district.

The sedimentary beds consist of alternate layers of quartzite and limestone (probably of carboniferous age) which trend northeast and southwest, and "dip"

to the northwest at an inclination varying from fifteen to thirty-five degrees. Prior to the deposition of mineral ores, the strata had been rifted by the intrusion of enormous dykes and thin sheets of porphyries which traverse all directions. The chief, and probably earlier flow, has a trend nearly northeast and southwest, traversing the entire mineral district and having a maximum width of more than 2,500 feet. This great dyke separates the mines of the district into two sections. Although practically all of the great ore bodies of the district are found to occur in the same geological horizon in the sedimentary limestone, those mines situate on each side of the dyke have distinct and separate apices within segments of the same strata. The Highland Boy (Utah), Bingham and New Haven, Yampa, Jay Gould, Maxwell, Utah-Apex, Butler-Liberal, and a great number of other valuable properties being on the northwest side of the dyke, whilst the properties of the Boston Consolidated Mining Company, the Bingham Gold & Copper Mining Company, the Kempton, the vast holdings of the United States Mining Company, the New England Copper & Gold Mining Company, and many other valuable claims that cannot here be enumerated, are situated on the southeast side of the dyke.

Portions of this great dyke have been profoundly crushed, brecciated and impregnated with original copper sulphides to an extent which renders a vast area of it susceptible to most profitable mining, and this feature will receive further mention in another portion of this chapter.

Subsequent to the upheavals of eruptive rocks mentioned above, and doubtless incident thereto, innumerable fissures were produced having a "strike" or tend nearly north and south, and, in most instances, dipping slightly to the west.

These fissures not only pierce the sedimentary beds, but the porphyries as well, and in many instances trans-sect the entire district, extending, no doubt, to profound depths, affording numerous channels through which dissolving and fertilizing solutions were brought into contact with the soluble limestones, and thus, atom by atom, were vast areas of the sedimentary rock removed and in place thereof was builded mountains of metaliferous ores in which is still preserved the structure lines of the original rock. As indicated by the latter observations, the ore deposits of the district in so far as they occur in the lime strata, are of the class called "substitution" or "replacement" veins, and are "appendages of the fissures." But where occurring in the quartzites, or porphyries, they exhibit the usual banded fissure structure, and whilst the yield of the latter class has been and continues to be, very considerable in amount and of excellent grade, the vast tonnage required to supply the several valley smelters is chiefly derived from the deposits in the limestones. The present yield of smelting ores of the district is about 2,000 tons per day divided as follows: The Utah Company, 550 tons; Bingham Gold & Copper Mining Company, 500 tons; U. S. Mining Company, 450 tons; Boston Consolidated Gold & Copper Mining Company, 200 tons; Tintic Mining and Development Company (Yampa mine), 250 tons; Butler-Liberal and all others, 50 tons. In addition the Highland or Utah Company has near completion additions to its smelter which call for an addition of 250 tons. The Yampa output will also be increased by 200 tons. The Boston Consolidated will soon increase its shipment to 500 tons daily, whilst the Bingham and New Haven, Utah Apex and Kempton-Ashland will soon be preparing to commence shipments in quantities ranging from 150 to 500 tons each daily.

The most important development of recent date occurred in the Red-Rover claim controlled by Col. Wall, and consists of "fero-cuprous" sulphides containing high gold and silver values. This ore body has been developed on its strike easterly and westerly for a distance of some four hundred feet and is exposed a maximum width of more than one hundred feet. Its great strength and richness

SECTION OF UTAH COPPER COMPANY'S MILL, BINGHAM—ONLY ONE-SIXTH PROPOSED SIZE

is doubtless attributable to its parent, the "Giant Chief" fissure, which trends north and south, cross-cutting the limestones at this point and extending into the underlying quartzites to the south, where it has a long record of production of valuable ores. The ore body dips to the north in the direction of the great dyke beneath the Kangaroo claim, of which it is the good fortune of the U. S. Mining Company to be the possessor of an undivided one-fourth interest, the other three-fourths being owned by Col. Wall, and it is confidently believed that its continuity will not be intercepted by the "dyke" until it shall have passed through the greater portion of that claim. This great ore-body was unexpectedly discovered in a lateral drift from the "Evans Tunnel," which was driven by the United States Mining Company for the development of its "Old Telegraph" mine, situate several hundred feet farther to the south.

We now recur to the peculiar conditions before referred to as existing in the great "Old Jordan" mine. As indicated by its enormous production, the ore body was of great width at the surface. It had the usual northwest dip. The surface of the earth in that direction is nearly level for a distance of some four hundred feet, then gradually rises to a slope of probably thirty degrees to a vertical height above the apex of the lode of about 150 feet, where it again forms a comparatively level "mesa." The ore body enters the earth upon a dip of about thirty-five degrees, and so continues to a depth of forty or fifty feet, then suddenly assumes a horizontal position, which is maintained for some four hundred or five hundred feet, then gradually rises conformably to the outer surface of the earth before described, until it reaches a vertical height of more than one hundred feet above the outcrop of its apex, where it is intersected by the "Clark raise" and "Coolidge stope" before referred to, but here the once great lead producer has by some mysterious process of nature been transformed into a repository of the more valuable metal, copper, in which the usual proportions of the precious metals persistently continue.

The cause of the peculiar condition found in this mine is attributed by Professor Holden and other able experts who have examined it, to what they call a "roll" or "fold" in the formation, such as is frequently met with in coal mines, and which in this case, according to Mr. Holden, extends easterly across the "Old Telegraph" lode, and other holdings of the United States Mining Company, and it is not improbable that the appearance of the ore body in the Red Rover mine at a point where its existence was unexpected is attributable to the influence of this great "fold" in the sedimentary beds. At the "Old Jordan," however, the situation was further complicated by a "faulting fissure" which passes obliquely through the lode and strikes southwest and northeast, and which has resulted in disconnecting the Kempton mine from the Jordan lode by a normal "down-throw" of some four hundred feet, and on the other hand producing a new apex upon which is located the Commercial mine of the Bingham Gold & Copper Company's holdings, and which has been developed upon its dip to a depth of more than seven hundred feet and is the chief producer of copper sulphides owned by that company.

In this connection it should be said that with the exception of the Commercial, and to some extent, the Highland Boy and Yampa mines, all of the present great producers of iron-copper sulphides were, in their superficial stages of development, producers of silver-lead ores, and that the former dominant metal, lead, has been superseded in the veins by iron pyrites accompanied by the more valuable metal, copper.

In addition to the "straight sulphide" producing mines briefly alluded to herein, the "Wall group of mines," consisting of some two hundred acres, and located upon the mineralized portion of the great Porphyry Dyke before referred

to, presents features of great geological interest as well as assurances of economic results exceeding anything heretofore attained in the history of the world's greatest copper mines. The property spans the narrow gorge cut in the mountains by main Bingham canyon and reaches to the summit of the mountain ridges on either side, it has been exploited by numerous tunnels driven into the mountains on either side of the gulch, distances ranging from four hundred to seven hundred feet and by a main working tunnel running obliquely across the others, also by six inch holes drilled at various points to a depth of five hundred feet below the floors of the tunnels. These works extend over an area of 2,500 by 3,000 feet, and disclose most uniform mineralization, the average copper contents being two and two-tenths per cent., or forty-four pounds of copper per ton of rock, and in addition thereto, values of 60 cents in gold and small values of silver are equally persistent. The copper occurs as "bornite," "glance," and chacopyrite in very small hard grains, replacing the original biotile of the porphyry, occupying small cells in the rock, and not combined, or "frozen" to it. The porphyry, being exceedingly light, soft and friable, renders reduction of the ore by ordinary methods of crushing and concentration extremely simple. Workings thus show a recovery of about eighty per cent. of the contents, including gold and silver.

W. H. TIBBALS
Mine Owner and Leading Mine Broker of Salt Lake City

The property is owned by Col. Wall, with the exception of a one-fourth interest which he sold to Capt. J. R. De Lamar some years ago, and which Capt. De Lamar later sold to C. M. MacNeill, the Penrose Brothers and others composing the United States Reduction Company of Colorado, and with whom Col. Wall, several months ago, entered into a contract of sale for a controlling portion of his remaining interest, retaining one-fifth of the entire property pending their option to purchase. The parties, as part consideration, have constructed a modern concentrating plant designed for the present to have capacity to treat 500 tons of ore per day. The mill is now complete and in operation and indicates a capacity of one thousand to twelve hundred tons per day instead of five hundred tons as contemplated, the increased capacity being due to the facility with which the ores yield to the process of treatment, the percentage of recovery is fully up to, and will soon exceed expectations. The resulting concentrates show average copper contents to exceed thirty-five per cent. copper.

The mill will at once be increased to a capacity of six thousand tons per day.

The mining will be done by methods known to miners as the "mill hole" process, and it is expected that the cost, when properly equipped, will not exceed fifteen cents per ton, to which will be added milling costs not exceeding twenty cents per ton. The railroad freight now costs twenty cents per ton, but the owners will later provide their own facilities, when this cost will probably be reduced to five cents per ton.

CAPT. D. McVICKIE

If any one should doubt the capacity of the mine to furnish that quantity of ore per day, let them estimate the number of tons that would be contained in a solid block 2,500 feet by 3,000 feet by 500 feet deep, or even that contained above the present tunnels which would be about equal to the same surface dimensions by 100 feet deep, or can such low grade material be profitably worked at all? Let us assume 44 lbs. copper per ton at 8c per lb. equals $3.52, add 75c gold and silver equals $4.27, at eighty per cent. equals $3.41 less mine, mill and transportation costs, 55c, equals balance profit $2.61. Will it pay? The answer is found in the present operation of the mill, constructed under the direction of Mr. D. C. Jackling, general manager of the United States Refining Company of Colorado and of the Utah Copper Company, assisted by Mr. Frank Janney, superintendent of the Utah Copper Company.

Compare those figures with the official annual reports of four of the leading mines of the Lake Superior region, the ores of which are treated by an exactly similar process, i. e., concentration, to-wit:

One ton of rock from Wall's Bingham mines contains 44 lbs. of copper, yield of 80 per cent. give net yield per ton of rock fine copper 35.2 lbs., costs, per ton of rock $0.55
Mohawk rock, fine copper, 21.79 lbs., costs per ton of rock..... 1.92
Isle Royal rock, fine copper, 15.7 lbs., costs per ton of rock..... 1.86
Osceola rock, fine copper, 17.4 lbs., costs per ton of rock..... 1.65
Quincy rock, fine copper 19.3 lbs., costs per ton of rock..... 1.88

The Mohawk earned net on the selling price of its shares 8 per cent.

The Isle Royal earned net on the selling price of its shares 6 per cent.

The Osceola earned net on the selling price of its shares 8 per cent.

The Quincy earned net on the selling price of its shares 6.7 per cent.

The yield of the Atlantic was only 12.6 lbs. per ton of rock and it earned a handsome profit; has paid in dividends to date $940,000.

The yield of the Calumet and Hecla, the great mine of the world, for 1903 was 35 lbs. fine copper per ton of rock. Its cost is higher than those quoted, but it makes no report. It has paid in dividends to date $81,351,000 and for 1903 $1,500,000.

The cost of smelting Wall's Bingham per ton will be considerably less than value of gold and silver contents, and copper is worth much more than 8 cents per pound.

Transportation facilities for this camp are the very best. The Copper Belt Railway connects with the Rio Grande Western Railway at Bingham and extends up main Bingham Canyon some three miles to the Commercial group, the property of the Bingham Consolidated Mining Company, and crosses the property of the United States Mining Company, the Utah Copper Company, the Ohio Copper Company and others. A branch of this railway also extends up Carr Fork to the Yampa, the Boston Consolidated, the Maxwell group, and others, and to within a few hundred feet of the main working tunnel of the Utah Consolidated Mining Company.

From Revere Station, three miles below the town of Bingham, a branch of the Rio Grande Western Railway extends three miles to the Dalton and Lark group, the property of the Bingham Consolidated Mining Company.

The United States Company and the Utah Consolidated each have in operation aerial bucket tramways which deliver their ores at the Rio Grande Western Depot, from which point the railway connects with all the valley smelters.

The development of the Bingham mines has brought to the camp the services and association of such conspicuous operators as Mr. Samuel Newhouse, who promoted the Utah Consolidated (Highland Boy), and who is now managing director of the Boston Consolidated; Captain Duncan McVichie, general manager of the Bingham Copper and Bingham Consolidated Copper and Gold Mining Companies; Mr. R. H. Chaning, under whose management the Utah Consolidated (Highland Boy) has entered upon such a remarkable dividend paying career, and Mr. George H. Robinson, a mining engineer of national reputation, under whom the Yampa mine and smelter are now contributing to the State's wealth.

On the west side of the Oquirrh range, which is also in reality part of this district, a great deal of work is being done with most promising indications. Since the conditions, geological and otherwise, that have made Bingham what it is, exist unmistakably in the territory that lies over the crest of the range, there is no apparent reason why this hitherto unworked territory should not prove equally as valuable as the area east of the range's crest. Notable among those industriously and continuously engaged in demonstrating the value of the western slope of the Oquirrh range are the Bingham Copper Boy and the Great Divides Mining Companies.

Bingham is an incorporated city. It has a population of some 6,000, but these are scattered over a very considerable area. There are employed in the camp at the present time approximately 2,000 persons directly connected with the mines. These men average approximately $2.75 per day each. The mines of this camp are therefore paying directly close on $2,000,000 annually. Some estimate may thus be had of the value of this camp to Utah when the labor directly dependent on the Bingham mines is considered.

Stockton—Dry Canyon—Ophir

The Oquirrh range of mountains, west and slightly south of Salt Lake City, embraces a mining district whose present tonnage exceeds that of all others in the State combined, and indications are that it will continue the same relative production indefinitely. The range is some thirty miles long and varies from five to ten

miles in width. Within the area of this range are embraced the Bingham mines on the east, which also overtop the crest of the range and run down the western slope; the famous Mercur district on the south, as well as the Sunshine territory; the Stockton, Ophir and Dry Canyon districts on its western foothills, and the West Dip and other districts on the foothills to the southwest. Very rich ore has been found in all these districts, excepting perhaps in Sunshine and in West Dip districts, but the magnitude of the ore bodies this range has been shown to contain is unrivaled in few places in the world. Gold, silver, copper and lead are its principal minerals.

WILLARD F. SNYDER

When many of the now prominent mining districts of this State were undreamed of the territory embraced by the Stockton, Dry Canyon and Ophir districts was pouring out its riches in quantities never since equaled. The fall in the price of silver, and the slump in lead, practically killed these districts, which are all contiguous and really embraced in one general area having common geological conditions. Less than twenty years ago Bingham was considered a camp that would never again experience the prosperity it once knew. The production of this camp then was as a drop in the bucket compared to the output to-day.

With the introduction of labor saving methods in mining, and metallurgical discoveries that resulted in vast savings in the cost of smelting, attention of mining men was again turned toward the Ophir, Dry Canyon and Stockton districts. Periodically work has been prosecuted on the Ophir Hill Consolidated property at Ophir, until Col. E. A. Wall, A. G. Campbell and T. R. Jones secured it and installed a plant for the economic handling of the vast ore reserves of this property on a large scale. The result was the concentration and sale of its ores at a distinct profit. It was later purchased by Senator W. A. Clark, and under the management of Mr. E. W. Clark continues to yield a splendid tonnage of low grade ores. Then Mr. C. H. Schue, aided by Mr. E. J. Raddatz, one of the persistent believers in the ultimate prosperity of the camp, interested such men as P. L. Kimberly, W. F. Snyder, M. H. Walker and others in some of the old Stockton mines under the name of the Honerine Mining & Milling Company. Capt. Duncan McVichie discovered virtues in the Galena King in the same vicinity, while Mr. Joseph Dederichs and others also took a hand later. Examination and exploratory work satisfied all concerned of the presence of vast bodies of silver-lead ores that could be worked to an undoubted profit. New life was infused into the old camp, and a campaign of development begun that promised to

realize everything hoped for long years. The front in all this work was at once taken by the Honerine people; but the inflow of water was so great as to menace every hopeful aspect of the undertaking. A tunnel was then projected to unwater the vast territory owned by the Honerine. This tunnel, about a mile and a half long, has already drained several of the mines higher up than the Honerine, and work on these has been resumed. Previous explorations had demonstrated not only the continuity of the veins known to exist, but had disclosed others of which there was no indications whatever on the surface. All this made the territory sought to be freed from water still more valuable, and the construction of a concentrating mill, with a capacity for concentrating 600 tons of ore daily, was commenced. This was to handle the limitless bodies of ore that would leave little, if any, margin to be shipped to the smelters, and was in no wise intended to affect the equally extensive bodies of higher grade ores that had been proven to exist in the company's ground. This mill is now completed at a cost of about $100,000, and is beginning to bring in the first returns the owners have had for nearly three years' work. In these days men do not expend vast sums of money in mining without the most absolute assurance of returns, and as the owners of the Honerine have spent nearly three-quarters of a million dollars to get at the ores, it puts the question of the extent and certainty of the ore bodies in the Honerine and contiguous territory absolutely at rest. The long bore will be finished in a short time. Already the water is receding, and the contributions to the ore tonnage of the State from this mine and adjoining properties is certain to be record breaking. Mr. W. F. Snyder, of the Western Exploration Company, is manager of the property, and E. J. Raddatz the superintendent, under whom all the work referred to has been done. The company's mill is said to be the most perfect of its kind in the West.

Writing of the geological formation of this district, Mr. F. H. Perkins says, among other things: "The contacts of the limes is where the most of the ore bodies are found. The east and west veins, or bedding planes, are nearly continuous ore bodies, regardless of ore chutes, because the north and south fissures, which cross them at right angles, are so large and close together, and have been such good passageways for the mineral-ladened solutions, that the beds, being acted on at such short intervals, have been completely filled with ore before the north and south fissures became recemented and the source of ore cut off. Some of the lime beds are so tight and metamorphosed that the alkaline solutions had little or no chance to dissolve the lime and deposit ore in its place. But the gray lime and some of the silicious limes were so readily attacked that it is their contacts which are the most favorable for making ore. So far none of the mines are opened up deep enough to know how far this lime belt goes down, but judging from the length of the area titled on end, there is little danger of ever going through it. Water will stop the mining long before any such conditions will present themselves. The district seems to be a series of rectangular sections which have been so constructed and walled in by porphyry and other material through which water will not drain, that each rectangle is a tank, and until that particular section is drained, little show for sinking in that space can be looked for to any considerable depth."

Some 400 men now find steady employment in the three camps formerly abandoned. Besides the Ophir Hill and Honerine mills, there is also one on the old Mona mine in Dry Canyon district.

The Mercur District

Mercur, known as the "Johannesburg of Utah," because of its large bodies of gold ore that can be reduced by the cyaniding process, is situated in the Camp

Floyd mining district. It is located at the southern end of the Oquirrh Mountains, a range that is only 30 miles long and from 10 to 12 miles wide, but which yields a tonnage of minerals exceeded by few equal areas anywhere. The camp is reached by rail. First it was known as the Lewiston mining district, and about 1870 and 1871 was noted for the unusual richness of silver ores found there. But these failing, the camp was later deserted entirely. It was known that cinnabar existed in the district, and while assays showed the presence of gold, no colors were ever obtainable as a result of panning. Later Arie Pinedo located a claim on a cinnabar vein and called it the "Mercur," after the mercury in the ore. This is

CONSOLIDATED MERCUR GOLD MINES CYANIDE MILL—1,200 TONS CAPACITY DAILY

the origin of the camp's name. To the present time Mercur district has yielded some $12,000,000 in gold, while in the Sacramento mine quicksilver is to-day being extracted at a profit.. The Sacramento and the Consolidated Mercur Gold Mines are the only properties now in active operation in the camp.

Carboniferous limestone is the country rock that prevails in the Mercur district. In the Mercur Basin there are exposed sedimentary beds of an aggregate thickness of 12,000 feet, the mineral veins occupying a place near the middle of this series of stratified rock. About a mile southwest of Mercur, down the Lewiston Canyon, is the summit of an anticline, with northwest axis, the canyon cutting across it at about right angles. At the axis the strata lie horizontally. Going either up or down the canyon from this point the strata gradually change from the horizontal and begin to dip to the northeast and to the southwest, the dip increasing with the distance from the axis. The district is thus divided into two parts, called the "East Dip" and the "West Dip." Mercur is on the east and the dip of the vein there is from 15 to 20 degrees. In the "West Dip" the veins and strata are much steeper, the incline being about 35 degrees.

Formerly it was held that there were two veins at Mercur. It is customary now to say there are four—the silver vein, and the upper, middle and lower gold veins. The silver ledge is below the gold ledges, and is that from which silver was mined in the early days, but the values were too variable, and the occurrence of ores too uncertain to induce continued work thereon. Lying immediately upon the silver ledge is the lower gold ledge; 100 to 150 feet above this is the middle ledge, and some 40 feet higher still is the upper gold ledge.

The chief vein is the middle one, which averages about 20 feet in thickness, though it has widened out to 70 feet at points, while the upper vein averages over 12 feet in thickness, though in the Golden Gate mine an ore body 90 feet in thickness was exposed. The ores run in chutes as in many other formations. The veins or ledges are continuous for several miles in extent, and were readily found by prospectors. While small quantities of gold are always present in the vein, the mineralization is not so uniform that the discovery of the vein implies the discovery also of ore that will pay. Some of the highest grade ores come from points where the vein is widest, as in the case of the 90-foot ore body in the Golden Gate mine.

The principal minerals of the silver ledge are silica, calcite, barite stibnite, silver, and a little gold, but not a trace of lead. The gold ledges, in addition to some of the foregoing, contain also realgor, orpiment, cinnabar, pyrite and gold, but no silver. No one has been able to see gold in the ore, even by the use of a microscope.

The extent of the ore bodies is undeterminable, that is, the extent of ore bodies of such character and with such values as will pay for the working. The area covered with ores of the same general class as are found in Mercur district proper is very extensive. They are found some three miles to the south, and to the west some five miles, where north and south veins containing adequate values extend for perhaps seven miles. At present slimes in the veins of the area outside Mercur itself prevent the successful and economic working of the ores, so that, while the values are there and the extent of ores practically beyond computation, new methods are yet to be devised for the profitable extraction of the gold. Already, in measure, this obstacle has been overcome, and when it is recalled that all the ores of this wonderful district were without any commercial value until the application of the cyanide process to them less than ten years ago, it goes without saying that a method of profitably obtaining the values from the ores on the west dip, and in the area south of the Mercur mines, will yet be discovered. Savings also will be introduced which will afford satisfactory returns for the handling of ores, the values in which, at this time, are inadequate to warrant their working. Of these the Consolidated Mercur Mines Company has absolutely unlimited quantities, while the area outside that company's ground containing ore of this character is such that it can be worked on the vastest scale for limitless time without apparent diminution in the quantity.

The unexplored territory of the Consolidated Mercur Gold Mines Company is practically limitless, and as exploratory work in the past has only served to demonstrate the continuity of vast bodies that will pay to handle under processes now employed, the life of the property, without the discovery of methods for the practical and profitable working of ores in which the values are lower, or in which slimes now operate as a bar to a handling sufficiently economic, is assured for an indefinite period. At the time of its completion the cyaniding mill of the Consolidated Mercur Gold Mines Company (picture of which is here given) was the largest plant of its kind in the world. It has a capacity of approximately 1,200 tons of ore every 24 hours.

The Sacramento Gold Mining Company also has a mill and a plant for the saving of quicksilver.

Some 400 men are now employed in and about the camp, and this number will be added to indefinitely if experiments now being made shall result as successfully as hoped for.

Tintic District

Tintic is one of the earliest mining districts in Utah. It covers an area about eight miles in length by two miles in width, and is separated by distinctive formations into what may be called the south and north halves. The south half is a porphyry area, the veins ranging from two to ten feet in thickness, and are very rich in silver and lead. The veins run north and south. They were worked to a depth of 150 to 300 feet when pyritic iron, carrying only small values in the precious metals were encountered. The general supposition being that the veins had failed, work was suspended. In 1893 William Hatfield relocated the old Swansea, which in the past had yielded $1,000,000, and began sinking a shaft. He worked in a small way till the fall of 1895, when the shaft passed the iron zone and disclosed a very rich lode of silver and lead ore. Since then extensive developments within the limits of this rich lode have demonstrated that the valuable ores underlaid the iron cap, and a new era was inaugurated in the porphyry area to the south end of the district, and in the vicinity of Silver City.

In the north half of the district the minerals occur in wide belts of limestone, ranging in width from 150 to 600 or more feet. The ore bodies occur in the form of great lenticular masses of quartz, carrying gold, silver, lead and copper as the valuable minerals, while in places the ores are rich in iron and manganese. Copper ores also occur, particularly in the Eureka Hill, in the north end of the district, and in the Mammoth, Ajax, Carisa, Victor, Boss Tweed and North Star properties in the south end of the north half of the district. In the northern portion of the district, around the town of Eureka, the principal values are in gold and silver, the lead occurring in the form of a carbonate near the surface and in galena at greater depth, the exception to this condition being found in the Eagle mine, which has produced principally gold, and in the Centennial-Eureka mine, where gold occurs in considerable quantities, representing, it is believed, fully one-half of the value of its output.

The gold bearing rock, as a rule, occurs in the bedding planes of the lime, forming cross country veins within the mineralized zone, having a strike and dip coincident with the bed of the country. The formation is pseudomorphic after the lime.

The silver usually occurs in veins forming in more or less regular north and south lines, with a general dip to the west, cutting the formation of the country at an acute angle both in strike and dip. The ore occurs in distinctive chutes, usually connected one with another by pipes or ore channels running almost any direction from the horizontal to the vertical. From such an ore pipe or chute the large ore output from the Bullion-Beck was derived for some years.

Even the deepest workings in Tintic—in fact, all the workings—are absolutely free from water. Mines in this district have been continuously worked during the past thirty-four years, and have added to the world's supply of the precious metals, together with the lead and copper and iron contained in the ores, many millions of dollars.

The workings in the various mines are extensive, and while the total aggregate of development is not obtainable, it is believed by the well-informed mining men of the district, that the total underground workings in the mines of the district would not fall short of seventy-five miles.

A peculiar feature of the district, and one conclusively demonstrated by the deepest workings, is that the gold values increase with depth. It is the only

instance ever known of where silver, lead and copper veins have lost the base and silver values with depth and increased their gold values, the gold occurring in deposits of quartz associated with barita, usually known as heavy spar. While the general average of the values is maintained with depth, the gold extracted, as compared with the gross output, is constantly increasing.

Latterly discoveries reported in the Gemini-Keystone and Bullion-Beck groups of mines have satisfied many that the great ore zone on which the Mammoth, Grand Central, Centennial-Eureka, Bullion-Beck and Gemini-Keystone and other mines are known to be located, extends to the north undiminished in size and in the wonderful richness of its ores. On the Dagmar-Northwest and Raymond and Illinois groups, therefore, shafts are being sunk with every prospect of proving that the great ore bodies which have made the wonderful Centennial-Eureka famous among the world's noted mines, run still to the north unimpaired in volume and in values.

Cheaper smelting and railroad rates have reduced the tonnage of ores that formerly were concentrated in the mills of this district. These, when in operation, have a capacity for handling about 800 tons of ore daily. The volume of ores and concentrates from this district to the smelters in Salt Lake valley for 1893 approximated 225,000 tons.

Close on 1,500 miners are employed in this district, with wages averaging $3 per day per man for 365 days in the year—an increase of nearly 100 per cent. above the output of the preceding year.

Eureka is the principal mining camp in the district, and has every modern convenience and a population of about 5,000 souls. Robinson, Silver City and Diamond are other camps in the district named in the order of their importance after the city of Eureka.

Gold Mountain Mining District

While quite so far as a public knowledge of the existence of minerals is concerned, Gold Mountain mining district has but recently assumed the importance that those long identified with it have felt it was entitled to. That the developments in the Annie Laurie Mining Company's properties have had much to do with the existing impetus cannot be denied, and this truth is doubly emphasized by the fact that like geological conditions and similar mineralizations occur throughout the whole district. This warrants the conclusion that ore as it appears in the Annie Laurie may naturally be looked for in all parts of the district where the formation and mineralization are like those found in the Annie Laurie. Jeremiah Mahoney, M. E., writing of this district, says among other things:

"Speaking in a general sense, the geology of the area receiving my closest attention appears to be in the order of quartzite, limestone and shales, and these surmounted by trachyte of great thickness, excepting where it has been displaced by the immense porphyry dykes which traverse the county in a northwest and southeast direction. With due allowance for the effects of the profound fissuring, caused by the great intrusions of the quartz veins and porphyry dykes, it can be said, with reasonable certainty, that the general formation maintains its identity and continuity throughout the area of my investigations.

"The bedding of the sedimentary and metamorphic rocks, as disclosed by the contour of this detached mountain, as seen looking west from Marysvale, and particularly by the section examined by me, is so regular, in a general way, as to warrant the opinion that the uplift on the outer rim was fairly gradual and uniform, or at least not attended by any violent disruption; while the center of the range emphasizes the eruptive outlet of the great subterranean forces, bringing to the surface the great quartz veins and other intrusions, which now consti-

tute the well-defined and persistent mineral zone, embracing the Log Cabin, the Gold Development, the Annie Laurie and other meritorious mining propositions. These results are undoubtedly due to a series of volcanic movements, representing especially the Devonian, the Carboniferous and the Tertiary ages, and while each age has left an impress more or less distinct, it is probably impossible at this time to unravel and analyze all the changes and eruptive movements which have taken place in the various rocks, composing the general formation, and it is not necessary to do so, since the final result, as left by the ultimating process, is a series of parallel fissure veins, with several strong lateral associates, which, for width, persistency and unbroken continuity, cannot be surpassed by any mining region of which I have any knowledge. Nearly all the lateral fissures, the genetic relations of which to the great northwest and southeast fissures are completely established by abundant evidence, have a general east and west course, and the most prominent of them develop their greatest strength and most pronounced mineralization the nearer they approach the craters on the Sunshine and Edna properties, owned by the Log Cabin Mining Company. These craters, surrounded by great masses of quartz and mineralized porphyry, furnish every evidence that they are the most pronounced passage of the volcanic motion, required to prepare the fissures for the formation of the great mineral zone, of which they are the center.

A. E. HYDE, JR.

"Isolated small outflows of rhyolite, so glassy as to suggest obsidian, occur in a few places along the line of the mineral zone, but as they are not contiguous to it, they cannot be of consequence in the formation of the former or its vein filling. There also came under my observation a few small phonolite dykes, the most noticeable of which are on the ridge, separating beaver and Deer Creek Canyons.

The whole district possesses a structural formation promotive of vein filling, and carries those eruptive rocks which are the invariable accompaniment of ore. There are several small faults through the range of mountains embraced in the Gold Mountain Mining District, but are not of such a serious nature as to lessen the identity or obstruct the unbroken continuity of the vein. The Annie Laurie Mining Company's properties located on the northerly end of this district, as also the Annie Laurie Extension properties to the south of the Annie Laurie, do not show faulting of any perceptible magnitude. In fact, there is but one visible

lateral fault, according to Mr. Mahoney, which, he says in his report on the district, is at the head of the south fork of Deer Creek Canyon, where the strike of the fissures suddenly changes from a northwest and southeast to a due north and south course. This fracture is clear cut and rather short, and is a "thrust" or "reverse" fault. The amount of its displacement does not exceed the width of the vein. The practical bearings of the foregoing facts are not far to seek. They, and the conditions generated by them, as well as those responsible for their own creation, have a well attested manifestation in a great mineral zone eminently worthy of a liberal and intelligent exploration. They represent an inviting field for capital, and induce the conviction that, with thorough prospecting and development, there will be uncovered along this mineral zone several mines of the magnitude and productiveness of the Annie Laurie, whose outcrop, structural formation, and general surface indications are identical in texture and composition with the rest of the properties lying on this belt.

A striking example of what intelligently expended money will do in this district is demonstrated by the Annie Laurie mine, which three years ago was sold for less than $230,000 to the present owners, who have since that time developed it into a mine conservatively valued at between three and a half and four million dollars.

The Annie Laurie is situated at the extreme north end of the district, while the Log Cabin and adjoining claims are some eight miles south. Recent developments in these properties have demonstrated the absolute accuracy of Mr. Mahoney's conclusions. Gold ore varying in value from $20 to $200 per ton has been found in strong veins, and work is still being prosecuted upon the veins in which this occurred.

Between these two properties is situated the Gold Pan and the Annie Laurie Extension ground, which have ore in place, and which are doing considerable work towards the development of this country. Besides this, the Wedge and other claims are showing steady and profitable values in ore. On the ores of this and claims owned by the same parties a mill is now in operation. At the Annie Laurie a mill, with a capacity of 350 tons per day, is in constant operation, and it may be stated absolutely that at no time has the latter property ever presented so encouraging an appearance. The Sevier Mining Company, west of the Annie Laurie, is also operating a mill.

The district has been a lead and silver producer for over twenty years, as shown by the Bully and Webster group of claims; so that, while at present it is chiefly known as a gold region, it is not wanting in other minerals. Copper has also been found in the Bully and Webster, while the Deer Trail is one of the best known properties in the State.

Kimberley is the chief location for the territory surrounding the Annie Laurie. Some three hundred and fifty miners and mill men find employment in this section. For the district surrounding the Log Cabin territory and the area to the south, Marysvale, the present southern terminus of the Rio Grande Western Railroad, is the supply point. Perhaps 200 miners and mill men find employment in this end of the noted district.

Deep Creek District

What is commonly known as the Deep Creek territory is really a vast area which includes several distinct mining districts, all of which have been explored for many years, and to an extent sufficient to prove beyond question the great variety of minerals contained there no less than their certain extent. Practically every mineral of commercial value known to the State may be found in this area,

and found in quantities that, under conditions affording reasonable facilities for the transportation of ores, could be worked to distinct advantage. The distance of the mines, however, from railroad connection has been a steady bar to extensive operations and, with rare exceptions, the owners of properties there have been compelled to wait and hope for some cheaper method of transmitting the products of their mines than their hauling by wagon over vast stretches of the Great American Desert, in which the several districts, generally embraced under the term Deep Creek, are situated.

Among the mines that have, despite the very great expense involved in the transportation of ores, maintained steady operations and regular shipments, are the Utah and the Galena at Fish Springs. Especially is this true of the former, which has been developed to a depth of 800 feet, at which point the ore bodies continue in undiminished quantity and richness. This mine has marketed over $600,000 worth of ore that would average 50 per cent. lead and 145 ounces of silver to the ton, and has paid some $225,000 in dividends. The Galena also has produced and marketed over half a million dollars of lead and silver, and has paid nearly $75,000 in dividends. Other mines have also produced and shipped ore, and on one, the Midas, a mill is in operation for the concentration of ores so that the cost of transportation may be reduced to a point that will yield a steady profit for the operation of the property.

The existence of ore in the district in such quantities as would pay for the construction of a railroad has passed the point of interrogation, but conditions favorable to such a consummation, so long and hopefully looked forward to by those interested in that section, have yet to obtain. Roads can be built to all the districts and practically all the developed mines, at a minimum outlay, as grades are substantially eliminated, and for almost the entire year they are in excellent condition. All transportation is at present by horse, but the near future holds out hopes of a method of conveying ores to the smelter that will prove nearly as advantageous as the presence of a railway. This end is to be obtained through the employment of traction automobiles, several of which are now designed to meet the exigencies existing in the case of these mining districts.

Mining camps are found in Dugway, Ibapah, Granite, Detroit, Fish Springs, Deep Creek proper, Dry Canyon, Granite Creek, Gold Hill, Dutch Mountains, Clifton, and still others. Once a cheap means of transportation is obtained for the ores of this area, the tonnage of the State from the mines will be vastly increased, and the value of the State's gold and silver, lead and copper and iron product will be enormously added to.

Beaver and Contiguous Districts

The first extraction of metals in Utah was made in 1858-9 in Beaver County, when lead was run from ores and moulded into bullets to war against aggressive Indians. While time has not dealt as kindly with that district as with others, there is no dispute as to the presence in that area of ores of almost every kind and in inexhaustible quantities. Wherever work has been prosecuted it has demonstrated that the ores are not superficial, and the surface mineralization is so general and striking that it were folly to assume nature had spread her riches on top of the ground at the expense of their existence at depth. As far as any workings in the district have penetrated the earth, the ore continues in unabated strength, with a tendency to the making of copper. In fact the whole of southwestern Utah and southeastern Nevada appears to be a vast area in which nature has lavished a wealth of copper ores that would seem to be absolutely limitless in extent, and a great portion of which is of extraordinary richness. This is demon-

strated by the rich copper ores taken from the Apex mine (of the Utah & Eastern Copper Company's group), in Washington County, now being worked at a perpendicular depth of over 800 feet below the surface; and in the Horn Silver mine in Beaver County, which has followed its ore bodies 2,000 feet into the bowels of the earth, and which to-day is contributing silver, lead and copper ores to the State's aggregate metal tonnage. At periodical intervals the lead mines of the district have been worked, and while the long haul to the smelters has eaten up the profits there has been no instance of a diminution either in the size or in the value of the ore bodies. The Horn Silver mine has paid nearly $5,400,000 in dividends and has been worked without interruption for about thirty years. To this mine and the tonnage it gave was due the extension from Juab to Milford—over 100 miles—of what is now the San Pedro, Los Angeles and Salt Lake Railroad.

HON. A. B. LEWIS

Despite the financial complications that exist regarding some of the mining properties in Beaver County, the presence of ores is unquestioned, and the existence of extensive and permanent copper bearing zones is forever set at rest by the depth of the Horn Silver workings and the developments of the past eighteen months in the Cactus—the latest copper property to win the attention of Mr. Samuel Newhouse, whose name is indissolubly associated with the Highland Boy and the Boston Consolidated copper producers of Bingham.

Through the persistent and assiduous efforts of State Senator A. B. Lewis, the attention of Eastern investors was attracted to the possibilities of the copper area of Beaver County after a long period of neglect. Ten carloads of ore were shipped to Eastern smelters which averaged over 40 per cent. copper. So great was the quantity and so high the percentage of copper that the shipment created a sensation. On part of the claims from which this ore was taken the Majestic Copper Mining & Smelting Company was founded, developments prosecuted and a smelter erected. Direction of this company was surrendered by Mr. Lewis, after which financial difficulties beset it, in consequence of which operations have been temporarily suspended. In no wise are these difficulties, however, chargeable to a failure of the mines of the company, or to a diminution of the ore bodies. The whose district suffers, nevertheless, in consequence, and suffers undeservedly. As already stated, all work done, in all properties, has absolutely demonstrated the

permanence and value of the ore bodies. So far as the West is concerned it has yet to be shown that in one or two successful properties in a section are confined all the ores that may be handled with a profit. The history of the Horn Silver mine, and the vast expenditures being made by Mr. Newhouse preparatory to the reduction of the unlimited ore bodies in the Cactus mine, go to prove, first, in the Horn Silver mine, the long life of the mineral bodies in Beaver County, and second, in the Cactus, the faith of a most careful and successful investor in another property there. It is ridiculous to assume, therefore, that no other mines of magnitude and depth exist in that district.

Having this in mind, and being supported by the most capable expert investigation, Senator Lewis, despite the untoward effect of the Majestic's present condition, is continuing his efforts in behalf of this wonderful district with unabated persistence, and is destined to accomplish all he had hoped for when the ill-starred Majestic Company was launched.

Developments in the Cactus ledges have been prosecuted to such an extent that a contract has been made with the American Smelting & Refining Company for its ores, to continue for several years, and plans are out and contracts let for the perfect equipment of a concentrating plant with a capacity of 1,500 tons daily. Springs were bought by Mr. Newhouse at Wah Wah, a distance of nine miles from the property, and pipes are already laid to convey this water to the great property with which it is now connected. A tunnel over a mile in length is being run for the economic handling of the ores, and it is stated that between $750,000 and $1,000,000 will have been expended by the time the concentration and exportation of ores will have been satisfactorily inaugurated.

Senator Lewis' efforts are now bent in the direction of putting on a working basis what is perhaps the most extensive group of claims controlled by one of the largest corporations ever formed for mining purposes exclusively. This is the Monarch Mining Company. The project is backed by one of the wealthiest syndicates ever brought together for the purpose for which the Monarch is organized. This corporation is formed by the absorption of several other companies, notably the Imperial, which owned the widely known Comet—adjoining the famed Cactus —and the Massachusetts, and other mines; and the Royal Company, which was possessed of the well-known Montreal mine—adjoining the Old Hickory, from which the Majestic smelter was fed with copper ores during its run. Very many other valuable mining claims in addition to those named, belonged also to companies absorbed by the Monarch in the Beaver districts. Besides these, the new company has taken to itself the Manhattan group of claims at Pioche, Nevada—all of the above producing chiefly copper, with gold, silver and lead as well, but of secondary importance. The present Monarch likewise embraces the Pioche Consolidated Mining Company, whose great yield of silver ores in former days made for its owners millions of dollars in dividends; and finally it is also possessed of the Last Chance group of claims in Bingham Canyon, or West Mountain mining district, and any property in that camp has but to be named to indicate most desirable area. The purpose of the Monarch Mining Company is to mine, concentrate and smelt the ores which the ground it owns in the wide area covered by its properties will yield.

The geological character of the country in which the Last Chance group is situated will be found fully set forth in the chapter on Bingham. Speaking generally of the wide territory in southwestern Utah and southeastern Nevada, in which the Monarch's domains are situated, it may generally be said that nature has created such conditions there as to minerals that there seems no possible chance of the ore bodies having been cut off, or being superficial. Eruptive dykes permeate all through the section in question; and, by development, these have

invariably shown that the ore bodies occur at or near the junction of these eruptive dykes with the different formations. There is, therefore, practically no possibility for the ores to fail with depth.

The extraordinary percentage of copper ores above referred to, and in different parts of the area mentioned, is rivaled by the silver and gold and lead returns in notable instances. But these, while attracting attention, are of little lasting interest to the investor. The search is for larger bodies of ore with permanent average values sufficiently great to warrant extensive work at a fair profit. No field is more inviting, in view of the conditions named, than that now invaded by Mr. Lewis and his backers. That mines ere long will be developed in that section, yielding a tonnage to rival the most noted, is as certain as that one day is to follow another—mischief-makers and croakers to the contrary notwithstanding.

Stateline

This district is located in Iron County, some 16 miles west of Modena, on the San Pedro, Los Angeles & Salt Lake Railroad. It has not been widely prospected as yet, but considerable work has been done on the Ophir and Johnny mines there. The former has been extensively developed, and shows heavy and regular veins in which silver ore of remarkable richness occurs. A fine new mill with a capacity of 100 tons daily is on the property, but work has been suspended for some time because of legal complications respecting the ownership, which is in Michigan parties.

The Johnny mine, perhaps two miles west of the Ophir, is a gold proposition pure and simple. While the Ophir is dry the Johnny develops goodly quantities of water. Gold ore of phenomenal value is of frequent occurrence in this mine. A fifty-ton cyanide plant is in constant operation, and the mine, while steadily being developed and fitted for a greater extraction of ore, still yields a profit above all expenses and is numbered among the State's dividend payers.

Many of the properties in the district are being operated in a small way, and the presence of the ore bodies in the Johnny, as to extent and value, convinces others interested in the district that their properties are destined to rival the Johnny—and the assumption is by no means an unreasonable one.

Tutsagabet

A smelter owned by the Utah and Eastern Copper Company handles daily between 50 and 60 tons of the copper ores found in the Tutsagabet mining district, some eighteen miles north of St. George, the capital of Washington—the most southerly county in the State. It lies in the Beaver Dam Mountains, and has long enjoyed a reputation for having unlimited quantities of the highest average grade copper to be found in any mining district in the United States. The general formation is lime, in which a series of parallel fissures occur. In these fissures the ore appears in chutes. Not infrequently, however, the ore runs off into the bedding planes of the limestone. As already stated, the chief product of the district is copper ore of high grade, but gold, silver, lead and other metals are also present. One mine, the Black Warrior, is a vast mass of lead carbonate. For some fifteen years the Apex mine and adjoining properties, now owned by the Utah and Eastern Copper Company, have been successfully operated. The average value of the ores may be estimated when it is stated that the copper matte has to be hauled some sixty-five miles by wagon over very heavy grades to rail connection, and coke and all supplies hauled back for the same distance by the same means. The ore is carted by wagon three miles to the smelter, and even water

has to be carried by wagon the three miles back to the mine. The percentage of copper must, therefore, be very high to stand all this expense and still leave a profit. The distance to rail is being reduced one-third by the construction of a new road, which also affords an easier grade, and is better for bad seasons of the year. The fact that this road is being constructed by the Utah and Eastern Copper Company at its own expense, is an attestation of the value of the ores its mines yield, and of the faith of those heavily interested in the life of their property and of the district.

The obstacles mentioned will give a satisfactory reason for the failure of any general development in a district where one mine has done so much. For a distance of fifteen miles along the lime zone mentioned, claims have been located and ores, rivaling those of the Apex in richness, found. Developments in the Apex mine, the chief property of the Utah & Eastern Copper Company (which alone keeps the camp alive) have gone to a perpendicular depth below the surface of 800 feet, without any change in the character of the ores or variation in their extent and richness.

The whole of southwestern Utah is a vast copper-bearing area, and that the Dixie or "Tutsagabet" district, with the removal of obstacles now taking place through the enterprise of the Utah & Eastern Copper Company, is certain to become one of the most conspicuous in the West for the extent and high character of the copper ores it will yield. The especial area covered by the Tutsagabet copper ores is perhaps fifteen miles square.

At Silver Reef and Leeds, mineralogists and geologists were first confronted with the statement that silver existed in paying quantities in the sandstone reefs of the northern part of Washington County. The assertion was denied by scientists, but the mills kept on crushing the sandstone and taking out silver at a profit until the fall of value in that metal in 1893, when it could no longer be recovered at a profit, and the camp was abandoned. Many a house in Leeds and Silver Reef will assay high in silver, having been built of the silver-bearing sandstones so abundant there.

Large gypsum deposits exist in this neighborhood, and a superior quality of anthracite coal is found, though the vein is very small. Oils steadily flow from natural wells, but the distance to rail connection is so great as to render them commercially valueless.

Park Valley is a comparatively new district, located in the northwestern part of the State, about 20 miles north of the Southern Pacific Railroad. It produces gold and gives promise of becoming an important factor in the gold production of the State. Owners of claims are, in the main, men of limited means and developments have been slow, a condition that prevails in nearly all districts in the beginning unless values are sensational. The Century Gold Mining Company has a mill, which is regularly turning out gold, and the company is paying dividends periodically.

La Platte.—Superficial showings in this district, which lies practically midway between Logan on its north and Ogden on its south, would seem to indicate the presence of vast mineral lodes at depth. Remarkable disclosures of galena or lead ores first attracted attention to the locality, and these led to investigation, which showed that the country for miles to the north, east and west was all highly mineralized, and outside the particular locality of La Platte itself copper seemed to abound. Until lately systematic and extensive work has not been prosecuted on any of the claims, and while there is little reason to doubt that extensive bodies of both copper and galena are in that section, they are yet to be found in place.

Near Vernal, in Uintah County, besides the hydrocarbons already referred to

as existing in this section, are other minerals—notably copper. Very rich copper ores are found in the mountain ranges in this county east of Vernal, as well as other minerals. The great distance from railroad connection stands, however, in the way of extensive development, but as far as work has been done, and from superficial indications, the hydrocarbons are not the only wealth nature has stored up for this outlying section.

La Sal.—In the La Sal country, which lies in the southeastern portion of the State, very rich copper ore has been found, and the general formation and the occurrence of ore, together with the presence of both gold and silver in phenomenal values leave little doubt that another great mining district lies here awaiting with patience time for development. Here, too, the absence of transportation facilities is the great obstacle to more active work.

The same general statements apply to the mining districts in the Blue and Henry Mountains, where also copper, gold and silver ores are known to exist extensively, and to run very high in values.

Conclusion

The foregoing by no means covers either all the districts or all mining localities in the State, but those named are the more conspicuous. Not a county of the twenty-seven in the State but has minerals known to exist in quantities that might be worked to a profit. But capital is necessary, and that inclined to go into mining naturally seeks localities where conditions present the greatest certainties as to results, where labor and supplies are readily obtainable, and where the transportation of the ores and the hauling of supplies will not eat the heart out of the returns. Hence many promising districts must await local development or the overflow of mining capital from districts in which the common impulse now is to place money that can be secured for mining purposes.

Minerals Found in Utah

The following minerals are of record as occurring within the State. Such of them as are present in the ores of the active mines are steadily produced. Others are mined only as demand may justify:

Actinolite.
Agate.
Agatized Wood.
Alabaster.
Albite.
Almandite.
Alum, in varieties.
Alunogen.
Amethyst.
Amphibole, in varieties.
Anglesite, or Lead Sulphate.
Anthraconite.

Barite.
Barytocalcite.
Basalt.
Biotite.
Bird Guano.
Bismuth.
Bismuthinite.
Bismuthtite.

Calamine, or Zinc Silicate.
Calcite, in varieties.
Calcspar.
Carnotite.
Cats-eye Opal.
Cerargyrite, or Silver Chloride.
Cerusite, or Lead Carbonate.
Chalcanthite, or Copper Sulphate.
Chalcedony.
Chalcocite, or Vitreous Copper.
Chalcopyrite, or Copper Pyrites.

Dog-tooth Spar (Calcite).
Dolomite.

Elaterite.
Embolite, of Chlor-Bromid Silver.
Enargite.
Epidote.

Franklinite.
Feldspar, in varieties.
Floss Ferri.

Galenite.
Garnet, in varieties.
Geyserite.
Gilsonite (Uintaite).

Antimony.
Apatite.
Aragonite.
Argentiferous Galena.
Argentite, or Sulphide of Silver.
Arsenic (Orpiment, Realgar).
Arsenolite.
Arsenopyrite.
Asbestos.
Atacamite, or Chloride of Copper.
Aguite.
Azurite, or Copper Carbonate.

Bitumen.
Blende, or Zinc Sulphide.
Blue Vitriol.
Bog Iron Ore.
Bole, in varieties.
Bornite, or purple copper.
Bosjemanite, or Manganese Alum.
Brochantite.

Chalybite.
Chromite.
Chrysocolla, or Copper Silicate.
Chrysolite.
Cinnabar.
Clinochlore.
Clinoclasite.
Coal (Ignitic and Bituminous).
Conichalcite.
Copper (native).
Cuprite, or Red Copper Ore.

Dufenoysite.

Epsomite.
Erinite.
Erubiscite.

Freieslebenite, or Gray Silver Ore.
Fullers Earth.

Glauberite.
Gold (native).
Gray Copper Ore.

Halite, in varieties.
Halotrichite.
Hematite, in varieties.
Hornblende.
Horn Silver, or Cerargyrite.

Iron Ochres.
Iron Pyrites.

Jarosite.
Jasper, in varieties.

Kaolinte, or Porcelain Clay.

Lava.
Lignite, in varieties.
Limarite, or Cuperous Anglesite.

Magnesite.
Magnetite.
Malachite, or Copper Carbonate.
Mallardite.
Marcasite, or White Pyrites.
Marl, in varieties.
Melanterite.
Miargyrite, or White Ruby Silver.
Mica, in varieties.

Nitre, or Salt Peter.
Nitro-Calcite.

Obsidian.
Ochres, in varieties.
Olivenite.
Olivine.
Onofrite.
Onyx.

Paraffine.
Pea-stone (see Pisolite).
Petrified Wood.
Pharmacosiderite.
Phenacite.
Phosgenite.
Pickeringite, or Magnesia Alum.
Pisolite.
Pitchblende (Uraninite).

Quartz, in varieties.

Radiated Calcite.
Realgar.
Ribbon Jasper.
Rock Salt.

Sal Ammoniac.
Salt Peter, or Nitre.
Sanidin.

Hydrargillite.
Hydrocuprite, or copper ore.
Hydrosiderite.
Hydrosteatite.

Iron Vitriol.

Jet.

Limonite, or Iron Ore.
Lodestone, or Magnetic Iron Ore.
Luckite.

Micaceous Hematite, or Iron Ore.
Mineral Wax (see Utahcerite).
Mirabilite.
Mispickel.
Mixite.
Molybdate of Lead.
Moss Agate.
Muscovite, or White Mica.

Nitro-Glauberite.

Oolite.
Opal, in varieties.
Opalized Wood.
Orpiment.
Ozocerite.

Plumbago.
Prase, or Green Quartz.
Proustite, or Ruby Silver.
Pyrargyrite or Ruby Silver.
Pyrites, in varieties.
Pyrolusite, or Manganese Ore.
Pyromorphite, or Lead Phosphate.
Pyronene.
Pyrozene, in varieties.

Rose Quartz.
Ruby Copper (see Cuprite).
Ruby Silver (see Pyrargyrite).

Smithsonite, or Zinc Carbonate.
Smoky Quartz.
Soapstone, in varieties.

Sard.
Sardonyx.
Stalactites.
Satin Spar.
Selenite, or Transparent Gypsum.
Siderite.
Silicious Sinter.
Silver (native).

Talc, in varieties.
Tetrahedrite, or Gray Copper Ore.
Tiemannite.
Topaz, White, Yellow and Blue.

Uintaite (Gilsonite).
Uraninite (Pitchblende).

Variscite.
Velvet Copper.
Vitreous Copper Ore.

Wad, Manganese Ore.
Witherite.

Zeolites, in varieties.
Zinc Blende, or Zinc Sulphide.

Soda, Carbonate.
Specular Iron.
Sphalerite (or Zinc Blende).
Spinel.
Stephanite, or Black, Brittle Silver Ore.
Stibnite, or Antimony Ore.
Sulphide of Silver.
Sulphur, in varieties.

Tourmalin.
Trachyte.
Tremolite.
Tufa, in varieties.

Utahite.
Utah Mineral Wax.

Volcanic Glass.
Volcanic Scoria.

Wulfenite, or Molybdate of Lead.

Zincite, or Zinc Oxide.

Mining Parlance

ADIT—A level; a horizontal drift or passage from the surface into a mine.

ADVERSE—To oppose the granting of a patent to a mining claim.

AIR DOOR—A door to shut off the strong currents of air sometimes occurring in a mine.

AIR DRILL—A drill whose power is compressed air.

AIR SHAFT—A shaft for ventilation.

ALLOY—A combination of two or more metals fused together.

ALLUVIUM—Materials deposited by water.

AMALGAM—Gold and silver combined with quicksilver.

APEX—The top or highest point of a vein.

ARASTRA—A crude mill for grinding ore.

ARGENTIFEROUS—Containing silver.

ASSAY—A chemical test of mineral to determine quality and quantity.

ASSESSMENT—Work required yearly by law.

AURIFEROUS—Containing gold.

BACK—The roof of rock above any mine opening driven on a horizontal plane.

BAL—Cornish for the word "mine."

BARREN—Devoid of metal or mineral value.

BASE BULLION—Lead combined with other metals for smelting.

BED—A stratified rock formation.

BLASTING—Breaking of rock by the use of explosives inserted in drilled holes.

BLIND DRIFT—A drift connected with other workings of a mine at one end only. A cul de sac.

BLIND LODE—A vein without an outcrop.

BLOSSOM ROCK—Detached rock or ore indicating the presence of mineral veins.

BLOWER—A fan used to force air into a mine.

BOND—A written conditional option.

BREAST—The face of a tunnel or drift.

BROKEN GROUND—A rock stratum where the walls are poorly defined and the general formation unsettled.

BUDDLING—Separating ore by washing.

BULLION—Ingots of gold or silver ready for the mint.

BUMPING TABLE—A concentrating table with a jolting motion.

BUNCH—Usually a pocket or bunch of exceptionally rich mineral.

CAGE—A mine elevator.

CAMP—A mining town.

CALCAREOUS—Rock containing lime.

CAPPING—The rock or ground overlying minerals.

CARBONATES—Ore containing a considerable proportion of carbonate of lead, or of rich silver.

CAVE—Partial or complete filling of drifts or shafts or tunnels by earth and rocks.

CHIMNEY—The richer parts in lodes as distinguished from poorer ones.

CHLORIDES—A common term applied to ores containing chloride of silver.

CHAMBER—A large body of ore.

CHUTE—An elongated body of ore.

CLEAVAGE—A tendency of rocks to split in smooth, regular manner.

CLAIM—Ground held by a location.

COBBING—Breaking ore for sorting.

COLLAR—Top of a shaft.

COLOR—Particles of metallic gold found in the prospector's pan or horn after washing earth or pulverized rock.

COMPARTMENT—A shaft that is wide enough for two or more cages and is divided into compartments.

CONCENTRATOR—Machine for removing waste matter from mineral.

CONTACT—A junction of two kinds of rock, such as lime and porphyry.

CORD—A cord weighs about eight tons.

COUNTER OR CROSS VEIN—One vein crossing another approximately at right angles.

COUNTRY ROCK—The predominant rock formation of a district.

CRIBBING—The timbers use to confine wall rock.

CROPPING-OUT—Mineral or rock rising to the surface.

CROSS CUT—A level driven across the course of a vein.

DEAD OR DEVELOPMENT WORK—Any work performed in opening ground to reach ore bodies.

DILUVIUM—A surface deposit of sand, gravel or loam.

DIP OR PITCH—The slope or pitch of a vein or mine.

DIRT—Referring to rock broken underground.

DRIFT—A tunnel; a horizontal passage under ground.

DUMP—Where ore or rock taken from the mine is dumped.

DYKE—A wall-like mass of mineral or rock foreign to the general formation.

EROSION—Wearing away of surface ground by water or glacial action.

FACE—The end of a drift or tunnel.

FAULT—The displacement of a stratum or vein.

FISSURE VEIN—A crack or cleft in the earth's crust filled with mineral matter, distinguished from other veins because it cuts through all other formations instead of yielding to them.

FLOAT—Loose ore or rock detached from the original formation.

FLOOR—Bottom of a horizontal opening.

FLUME—A pipe or trough to convey water.

FLUX—Substance used to promote the fusion of ores.

FOOT WALL—Layer of rock beneath the vein.

FORMATION—The general geological conditions of a given mining area.

FREE MILLING—Ores that will separate by simple methods.

GALLERY—A drift.

GANGUE—Waste material mined with ore.

GASH VEIN—A shallow vein or seam.

GOPHERING—Digging shallow and irregular holes on a claim.

GUT—Taking out ore in sight without effort to keep the vein open or maintain ore reserves.

HANGING WALL—The layer of rock or wall over a vein.

HEADING—A vein of ore above the drift.

HORSE—A body of rock of same character as the wall rock occurring in the course of the vein.

HUNGRY—Barren or nearly barren of minerals.

IGNEOUS—Rocks of volcanic nature.

INCLINE SHAFT—A shaft sunk at any angle under 90 degrees.

IN PLACE—A vein, or ore, in its original position.

JIG—A machine for concentrating ore by means of water.

JUMP—Locating on another's claim.

LAGGING—Small timbers used to prevent rocks falling from above in a drift or stope.

LEVEL—A horizontal passage or drift into a mine from a shaft.
LITTLE GIANT—A jointed iron nozzle used in hydraulic mining.
LOCATION—The area of a mining claim which has been located.
LODE, LEAD, LEDGE—A body of ore.
MATRIC or MATRIX—Rock surrounding an embedded object.
MATTE—Made by roasting sulphur out of copper ore.
MILL RUN—A test of the value of a given quantity of ore.
MINERAL BELT—A zone of mineralized ground.
MISSED HOLE—Failure of a charge in a drilled hole to explode.
NATIVE—Virgin metal as distinguished from ore.
NUGGET—A lump of native metal.
ORES—Compound of metal with oxygen, sulphur, arsenic, etc.
OUTCROP—That portion of a vein showing at the surface.
OUTPUT—Gross production of a mine.
PANNING—Separating gold from gangue or gravel by washing.
PATENT—The government's deed.
PAY STREAK—A streak of richer ore in a vein.
PINCH—Contraction of the vein.
PITCH—The slope or dip of the vein.
PLACER—A surface gold mine—extracting gold from gravel by water.
POCKET—A rich spot in a vein or deposit.
PROSPECTING—Searching for mineral veins.
RAISE—An upraise in a shaft or an opening made from below.
RESERVES—Ore bodies developed and still in a mine.
RETORT—Amalgam after distillation; gold combined with other metals.
ROOF—The rock above a level or drift, as the floor is the rock below a level or drift.
ROYALTY—Percentage of gross or net ores paid by a bonder or leaser.
SALTING—Placing foreign ore in the crevices of a vein.
SAMPLING WORKS—Works for sampling and determining the values obtained in ores; where ores are bought and sold.
SCHISTOSE—Granite rock having a slaty structure.
SEAM—A thin layer of rock or ore.
SET—A joined set of timbers used to keep ground from caving into a mine opening.
SHAFT—A well-like passage into a mine.
SHIFT—A miner's work for one day.
SINKING—Extending a shaft or an incline further into the earth.
SLUICES—Troughs in which ore is washed.
SPIT—To light a fuse.
SQUIB—A fuse.
SPREADER—Timber stretched across a shaft or slope.
SPUR—A branch of a vein.
STAMP-MILL—A mill for crushing ore by means of stamps.
STATION—Chamber in a shaft cut out for pumps or other purposes.
STOPING—Excavating the ore from the roof or floor of the drift.
STRIKE—Direction vein takes on the surface with relation to points of the compass.
STULL—Piece of timber in a set which lies on top of other timbers and is near the roof.
TAILINGS—The refuse left after milling or washing ores, containing metals not saved in the first treatment.
TIMBERING—Putting in sets of logs or timbers to support ground at openings in mines.

TRIBUTER—A miner working as a lessee.
UPRAISE—An upward opening made from below.
VEIN—Rock lying between other rocks in which ore is looked for.
WASH—Loose rock and dirt deposited by water.
WHIM—A machine used for raising ore or refuse.
WHIP—Apparatus used for hoisting ore from a shaft.
WINZE—An interior shaft sunk from one level to another.

Colors of Precious Metal Ores

GOLD—Chiefly yellowish; varies to blue, brown black, gray and white.
SILVER—Chiefly gray; varies to brown, blue, green and black.
SILVER GLANCE—Blackish lead gray, metallic luster, cuts red.
RUBY SILVER—Ruby red, reddish black, and cuts red.
HORN SILVER—(Chloride), semi-translucent.
BLACK SILVER—(Stephanite), iron black.
GALENA—Looks like lead.

Brief Facts

Utah has a population of 300,000, an area of 84,970 square miles.
Land area 82,190 square miles.
Water area 2,780 square miles.
Highest mountain peak, 13,500 feet.
Elevation of valleys from 2,700 to 7,000 feet.
Area of Great Salt Lake, 2,500 square miles.
Utah is 275 miles in width and 345 miles in length.
Utah's pioneer band of 143 reached Salt Lake City July 24th, 1847, headed by Brigham Young. In three years the population had grown to 11,380.
In Utah gold has been found in coal and silver in sandstone.
Utah has a school population of over 90,000 and over 700 school houses.

Notes

The sego lily, drawn on either side of the front cover of this pamphlet, is the State flower of Utah.

The bee-hive is the ground work of the seal of the State of Utah, and, as the emblem indicates industry, it is a fitting one.

Average wage of male farm hands in Utah is $30 per month.

Utah has 1,600 miles of telegraph lines.

There are some 5,000 miles of telephone lines in the State.

Railroad trackage in Utah amounts to some 2,000 miles.

Utah has about 80,000 horses and mules, valued at $1,900,000; 60,000 milch cows, valued at $1,800,000; 200,000 head of cattle and calves, valued at $3,750,000; 1,900,000 head of sheep, valued at $4,000,000; 35,000 swine, valued at $200,000.

Statistics, incomplete and insufficient, give Utah 20,000 turkeys, 4,000 geese, 12,000 ducks, 700,000 chickens, 25,000 stands of bees. The latter yielded in 1903 over 1,300,000 pounds of honey.

Of the farming lands encumbered in Utah there are 165,244 acres. The total encumbrance thereon is $1,658,222, or practically $10 per acre.

The State's product of corn was 175,000 bushels of a value of $120,000, and was produced on 8,500 acres of land.

The production of barley was 225,000 bushels, having a gross value of $130,000.

Forty acres of ground planted to cotton in Utah produced 26 bales, weighing 13,000 pounds, valued at $1,000.

The jet of Whitby, England, is no finer than that in the San Rafael Mountains, Utah.

Utah has 27 counties.

Authorities

The matter in this book has either been prepared by or submitted to the available gentlemen held to be generally best informed on the several subjects treated. On the topics given below our authorities are named.

Irrigation.—A. F. Doremus, State Engineer.
Horticulture.—J. H. Parry, Secretary State Horticultural Society.
Sheep.—Jesse M. Smith, President Utah Wool Growers' Association.
Cattle.—J. C. Leary, Manager Stock Yards.
Schools.—D. H. Christenson, Superintendent Salt Lake City Schools.
Beet Sugar.—Thomas R. Cutler, Manager Utah Sugar Company.
Water Powers.—R. S. Campbell, Manager Utah Light & Railway Company.
Dairies.—Prof. C. W. Clark, Agricultural College.
The Great Salt Lake.—Dr. James E. Talmage, University of Utah.
Hydrocarbons.—Dr. James E. Talmage, University of Utah.
Coal.—Robert Forrester, Geologist.
Building Stones.—Dr. James E. Talmage.
Smelting—R. H. Channi g and W. H. Nutting.
Iron.—Robert Forrester, Professor of Geology.
Alta.—Tony Jacobson.
Park City.—Jno. A. Kirby and J. J. Daly.
Bingham.—Col. E. A. Wall.
Stockton.—W. F. Snyder and E. J. Raddatz.
Mercur.—Geo. H. Dern.
Tintic.—Geo. H. Robinson.
Gold Mountain.—A. E. Hyde, Jr.
Beaver.—Joseph Farren.
Tutsagabet.—C. H. Doolittle.

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DEC 1 1 1993			
JUN 2 1 1995			
JUN 2 6 [illegible]			

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